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Mixed Catalysts: DR. VLADIMIR N. IPATIEFF 605

Viruses and Their Part in Disease: PROFESSOR W. G. MACCALLUM 608

Obituary:

Adrian John Pieters: L. W. KEPHART; Dr. Erkki Mikkola: PROFESSOR RICHARD FOSTER FLINT. Recent Deaths 610

Scientific Events:

National Research Fellowships in the Natural Sciences; The Washington Heights Health and Teaching Center; Nominations for Officers of the American Society of Mechanical Engineers; Promotions and Appointments at the Rockefeller Institute for Medical Research; Honorary Degrees Conferred by Harvard University 612

Scientific Notes and News 614

Discussion:

The Relationship of Histamine to Anaphylaxis in the Rabbit: PROFESSOR CARL A. DRAGSTEDT, MAX RAMIREZ DE ARELLANO and ALFRED H. LAWTON. The Utilization of Iron by Anemic Rats: PROFESSOR MARY S. ROSE. The "Baboon Boy" of South Africa: PROFESSOR JOHN P. FOLEY, JR. Freezing of Hot and Cold Water: ROBERT S. CASEY; DR. WILLIS R. WHITNEY 617

Scientific Books:

The Hypothalamus: PROFESSOR C. JUDSON HERRICK 619

Societies and Meetings:

The Sixth Washington Conference on Theoretical Physics: DR. EDWARD TELLER and DR. M. A. TUVE 621

Special Articles:

Coenzyme I and Riboflavin Content of Livers of Rats Fed Butter Yellow: CHARLES J. KENSLER, DR. KANEMATSU SUGIURA and DR. C. P. RHODES. Bovine Pseudorabies or "Mad Itch" Virus: PROFESSOR ROBERT GRAHAM, C. C. MORRILL and DR. L. E. BOLEY. Inhibition of Bacterial Metabolism by Synthetic Detergents: DR. BENJAMIN F. MILLER and DR. ZELMA BAKER 623

Scientific Apparatus and Laboratory Methods:

Ethyl Methacrylate as a Mounting Medium for Embryological Specimens: DR. W. O. PUCKETT 625

Science News 6

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MIXED CATALYSTS¹

By Dr. VLADIMIR N. IPATIEFF

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It has long been known that the presence of certain substances (*promoters*) in a given catalyst increases its activity. But to explain how they influence a catalyst in a given reaction presents innumerable difficulties. Unrelated facts, generally observed by accident, have trickled drop by drop into the body of this science to form the mass of data on which various people have based various explanations of this phenomenon. Most of these have been inspired by the physical changes which take place. Because the rate of chemical reaction depends on the area of the surface of the catalyst, scientists saw in the promoters a means of increasing the surface of the catalyst, and thereby either increasing the amount of active center or preventing

the growth of crystals in the catalyst. No one paid much attention to the possibility of the promoters taking part with the catalyst in the rate of reaction, because it was not established that the catalyst itself could produce a definite chemical reaction with a catalyzed substance under suitable conditions (namely, such reactions as would agree with its chemical function). So, in order that one might see "chemism" in catalytic chemical reactions, and, with its help, try to understand them, it was necessary to discover a series of new reactions and their corresponding catalysts. Then by comparing the chemical properties of the catalyst and the substance on which it is to work, we can begin to understand the chemical reaction which will take place. This new knowledge will allow us soon to classify catalysts according to their catalytic actions based on their

¹ Willard Gibbs address, given at a meeting of the Chicago Section of the American Chemical Society, May 25, 1940.

chemical properties. The last forty years have already given us such a wealth of experimental data on chemical reactions that even now we are able to make certain predictions on the choice of a catalyst for a given reaction.

There exist to-day various physical-chemical theories which try to explain catalytic processes by the aid of the electron theory, ion theory and others. I do not dispute the benefits to be derived from such investigations, but it is my contention that we chemists must first investigate the chemical properties of catalysts, both simple and mixed, in order to understand the processes occurring from the chemical point of view. This was the purpose of our last work, and I want to tell you about some of the more interesting results obtained by us.

In many cases the role of a promoter can be explained only on a chemical basis. The case of aluminum chloride, hydrogen chloride, may be cited. Pure aluminum chloride is not a catalyst for alkylation unless hydrogen chloride is present, either added as such or formed *in situ*. Working with Drs. Pines and Schmerling,² I have shown that this is due to the fact that the hydrogen chloride is necessary for the formation of hydrogen aluminum tetrachloride, which is the true catalyst for the reaction.

The significance of the influence of the mixed catalyst nickel oxide and alumina, which I discovered in 1910-12,³ on the rate of catalytic hydrogenation opened a new page in the field of catalysis. The mixed catalyst nickel oxide and alumina further catalyzes the hydrogenation of camphor, fenchone, and other saturated cyclic ketones because alumina dehydrates the intermediate alcohols into unsaturated hydrocarbons which are much easier to hydrogenate than the original ketones.

The new investigations made by Drs. Corson, Kurbatov and myself⁴ showed that sometimes it is necessary to add only a very small amount of one catalyst to another of the same type to increase greatly the activity of the latter. We have made a number of systematic experiments with mixed catalysts containing reduced copper and different oxides, mostly chrome oxide, studying the hydrogenation of benzene and isopentene under ordinary pressure and 225° C. Under the test conditions, both of the pure components—copper and chromium oxide—were inactive, but as chromium oxide was added to copper, the activity rose abruptly to a maximum at 5 per cent. of oxide, and then fell with continued addition. We propose to call this composition of maximum activity the *eucoactive* composition. It will be interesting in the future to

study the dependence of the eucoactive composition upon the type of unsaturation and upon the operating conditions. Another problem for future study concerns poisoning and heat of deactivation as a function of chemical composition.

The subject becomes more complicated when we add a third substance, nickel, to this mixed catalyst. Our former experiments had established that nickel, with the carrier kieselguhr (70 per cent. Ni: 30 per cent. Si), can completely hydrogenate benzene at 50° C and one second contact time at ordinary pressure, and that neither copper nor chrome oxide, the components of the mixed catalyst, is able to produce this reaction even slightly. When copper and chrome oxide are mixed in proportions of 95 per cent. copper and 5 per cent. chrome oxide (eucoactive at 225° C), this mixed catalyst will hydrogenate benzene 16 per cent. in 90 seconds contact time.

Mixed copper chromium oxide catalysts are even more susceptible to activation by traces of nickel than copper alone. For instance, copper containing not more than 0.001 per cent. of nickel does not hydrogenate benzene at ordinary pressure and 225° in ninety seconds, and the presence of 0.005 per cent. of nickel raises the hydrogenation to 4 per cent. On the other hand, the hydrogenating activity of the 95 per cent. copper, 5 per cent. chromium oxide, is raised from 16 per cent. to 24 per cent. by the addition of 0.005 per cent. of nickel.

Another example of this amplifying effect is the following. The addition of 0.2 per cent. of nickel raises the hydrogenating activity of copper from 0 to 19 (per cent. hydrogenation of benzene at ordinary pressure and 225° C in a contact time of twelve seconds), whereas the same addition of nickel raises the activity of the 95 per cent. copper, 5 per cent. chromium oxide catalyst, from 2 to 62.

Dr. Corson and I⁵ also studied the performance of fourteen series of mixed copper catalysts containing different metal oxides. These catalysts were carefully made from reagent chemicals, and several compositions in each series were determined by spectrum analysis. Evidently there are many substances which, although catalytically inactive alone, possess the property of activating copper for the hydrogenation of benzene. Our experimental data show that one of the most important is that in studying catalytic reactions from a physical-chemical point of view, it is necessary to pay special attention to the purity of the catalyst. Pure copper, containing 0.001 per cent. nickel as determined by spectro-analysis, is not able to hydrogenate benzene at all under the conditions of 225° and ordinary pressure and a great contact time.

Our calculations show that when copper contains 0.001 per cent. nickel, one atom of nickel is surrounded

⁵ Corson and Ipatieff. (In publication.)

² Ipatieff, Pines and Schmerling, *Jour. Org. Chem.*, 5: 253, 1940.

³ Ipatieff and Matov, *Ber.*, 45: 3205, 1912.

⁴ Ipatieff, Corson and Kurbatov, *Jour. Phys. Chem.*, 43: 589, 1939; 44: 670, 1940.

by 90,000 atoms of copper, and benzene can not be hydrogenated under ordinary pressure. If we increase the nickel content to 0.002 per cent., where one atom of nickel is surrounded by 45,000 atoms of copper, we can detect a slight addition of hydrogen to benzene. With the nickel content 0.02 per cent., the proportion of copper to nickel atoms being 4,500 to one, benzene is hydrogenated 2.5 per cent. In the same contact time, if nickel is increased to .1 per cent., corresponding to 900 atoms of copper to one of nickel, the hydrogenation of benzene reaches 10 per cent.

In our experiments on the hydrogenation of benzene in the presence of reduced copper, we used Dr. Hahn's method of emanation for the study of the dependence of the activity of a catalyst on its surface area. The data without doubt are very interesting, but we consider them only as preliminary experiments, and can draw from them only limited conclusions. It was established that the addition of alumina or chromium oxide to copper brought about a considerable increase in emanating ability and, therefore, a considerable increase in surface. In order that a catalytic process would go like any other chemical process, it is necessary that the energy given out be able to prepare the neighboring molecules to go into the reaction and that this repeat itself indefinitely; then the catalyst will fulfill the role of *multi-actor*. The activating energy of a catalyst can be very great, but it will not be able to work if conditions will not be suitable for its action.

On the other hand, a catalyst with not much activating energy will be able to produce a desired reaction if the external energy be transformed into chemical energy which has a sufficient factor of tension. It is also necessary that this energy does not disperse but is handed on to the neighboring molecules with a sufficient factor of tension so that the reaction will continue.

THE POISONS OF CATALYSTS

Chemical literature contains many articles concerning the deactivation of catalysts from which we can draw one indisputable conclusion. The amount of a substance which can poison a catalyst can be so small that a molecular film will not cover the catalyst completely. A hypothesis was made on the basis of these data that only the active centers of the catalyst are poisoned, and this explanation, in turn, was used to confirm the existence of such centers in the catalyst. I do not intend here to criticize this hypothesis, nor the necessity of introducing such a term for the explanation of catalytic reactions, but I, nevertheless, believe that molecules of different chemical constitution will always be found in a catalyst. If the catalyst is a reduced metal, it will also contain the metal oxides (as shown by many analyses); if the catalyst contains

metal oxides, then some of its molecules will be metal hydrate oxides, etc. On the basis of my theory of catalytic processes, these molecules having a definite composition will serve as initiators of definite chemical reactions if the conditions will be suitable for this process. For example, only the presence of definite amounts of a particular hydrate of alumina oxide in an alumina catalyst will give this catalyst the ability to take water from alcohols with the theoretical yield at low temperatures. The same thing can be said about the presence of metal oxides in reduced metals and their hydrogenating activity.

A catalyst poisoner being introduced in negligible amounts can stop the action of a catalyst by weakening or paralyzing the action of the molecules producing a given process, in consequence of which the neighboring molecules will not receive a sufficient amount of energy and the process will choke.

We saw earlier that the addition of a minute amount of nickel to the mixed catalyst copper chromium oxide greatly increased its activity. But this mixed catalyst can lose its activity in part or completely, if we add to it a small amount of other substances such as lead, cadmium, bismuth, certain salts, etc. Dr. Corson and I studied the poisoning effect of several metals and salts on two mixed catalysts: copper-nickel and copper-chromium-oxide, under ordinary and high pressure. We took two catalysts for our study in order to show that a mixed catalyst activated by the addition of chromium oxide is better able to resist the action of poisons.

We took the hydrogenation of benzene as the reaction for our study of the poisoning of catalysts. The following table shows our results using 99.8 per cent. copper and 0.2 per cent. nickel as the catalyst, and bismuth, cadmium and lead as poisons.

TABLE 1
POISONING EFFECT OF BISMUTH, CADMIUM AND LEAD ON
COPPER AND NICKEL CATALYSTS

Poison wt. per cent.	Hydrogenation of benzene wt. per cent.		
	Bismuth	Cadmium	Lead
0.0	19	19	19
0.00001	16	20	28
0.0001	15	20	27
0.001	17	18	24
0.01	10	13	16
0.1	3	3	2
0.2	0	0	0
1.0	0	0	0

Conditions: T. 225°; C.T. 12 sec.;
H₂/C₆H₆ 7 Pressure: Atmospheric

At ordinary pressure, 0.1 to 0.2 per cent. of bismuth, cadmium or lead deactivates 99.8 per cent. copper and 0.2 per cent. nickel almost completely. Below 0.1 per cent. concentration, bismuth and cadmium have no effect, whereas lead functions as a weak promoter. This interesting behavior of lead was checked several

times with different catalyst preparations so as to make sure of the facts.

An alternative method is to study the poisoning effect under more severe conditions of time, temperature and pressure, choosing such conditions that pure copper may show sufficient activity to allow evaluation of the poisoning effect. The results are shown in Table 2.

TABLE 2
CATALYST COPPER POISONING BY BISMUTH, CADMIUM AND LEAD

Poison wt. per cent.	Hydrogenation of benzene		
	Bismuth	Cadmium	Lead
0.000	33	33	33
0.005	21	6	5
0.05	6	1	1
0.5	2	0	0
1.0	0	0	0

Conditions: T. 350°; reaction time: 12 hours; charge 50 cc of benzene, 5 gr catalyst, 100 atms of hydrogen; Apparatus: 850 cc Ipatieff rotating bomb with glass liner.

As may be observed, we obtained the same picture with poisoned copper at superatmospheric pressure as at ordinary pressure with poisoned 99.8 per cent. copper and 0.2 per cent. nickel.

We previously reported that nickel is more effective in the activation of 95 per cent. copper, 5 per cent. chromium oxide, than of pure copper. Table 3 shows the effect of lead on the activity of this catalyst.

A comparison of the data of Tables 1 and 3 shows us that 0.1 per cent. of lead lowers the activity of the nickel-promoted 95 per cent. copper, 5 per cent. chromium oxide, from sixty-two to twenty-three (63

TABLE 3
POISONING OF COPPER CHROMIUM OXIDE NICKEL BY LEAD

	Hydrogenation of benzene wt. per cent.
Copper - 5 per cent. Cr ₂ O ₃	0
" - 5 " " Cr ₂ O ₃ - 0.2 per cent. Ni	2
" - 5 " " Cr ₂ O ₃ - 0.2% Ni	62
" - 5 " " Cr ₂ O ₃ - 0.2% Ni - 0.1% Pb	23

Conditions: T. 225°; C.T. 12 sec. H₂/C₆H₆ 7 Pressure: Atms.

per cent. drop) and that of nickel-promoted copper from 19 per cent. to 2 per cent. (90 per cent. drop).

As a result of these investigations with mixed catalysts containing activating and poisoning substances, we can make the following remarks. Our preliminary survey emphasizes the extreme delicacy of catalytic processes and the necessity of careful definition of purity before drawing conclusions as to the catalytic properties of any particular element of a catalyst. The sensitivity of the system benzene-hydrogen-copper competes with the spectroscopic in the detection of traces of nickel, bismuth and cadmium, and it goes beyond the range of the spectroscopic in its sensitivity to traces of lead. Therefore in the case of lead, at least, spectroscopic purity is no guarantee of catalytic purity, which means that in order to introduce into the catalyst traces of different promoters or poisons, it is necessary to prepare the catalyst by a special method to be sure of its composition.

In conclusion, I wish to state that for a thorough investigation of the mechanism of catalytic reaction it will be necessary to apply all the chemical and physical tools at our disposal.

VIRUSES AND THEIR PART IN DISEASE

By Professor W. G. MACCALLUM

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WHILE we are very familiar with the details of the lives of animal parasites, fungi and bacteria which invade and live and develop in the tissues of other animals and plants, producing diseases and stirring defensive reactions, all consistent with their living activities and with those of the invaded hosts, there are many other diseases, both of animals and plants, in which the invading agencies have only recently been recognized. This is because they are so minute as to escape all our ordinary means of making such things visible or evident through most of our usual methods of study, but recently new methods have been devised which afford enough information to reveal a whole world of extraordinary active contenders for propagation at the expense of the living creatures with which we have been familiar. These are the viruses, so-called

because of their harmful effects, but not yet sharply classified into groups since they vary so much in character, such as size and life history, that these subdivisions have not been completed. Some, such as those which cause typhus fever and related Rickettsia infections or those found in smallpox and vaccinia, are distinctly visible as very minute granules and can be traced in their relationship with the cells of the infected tissues, so that there is some question as to whether their nature may not be closer to that of the bacteria than is the case with other viruses which are so minute that they can never be seen.

But the matter of size, which in most cases is such as to allow the viruses to pass through a filter which has pores so small that no bacteria can pass and which has given rise to the name filterable viruses, is obvi-

ously not a fundamental distinction from larger incitants of disease. Other methods, such as differential centrifugation and ultra centrifugation, have been successful in separating these invisible germs from all bacteria and cells so that they can be obtained in pure concentration.

The further study has depended upon the demonstration of the relation of such purified viruses to susceptible animals, or to culture media, especially as to their power of multiplying themselves, their effect on tissues and the defensive response on the part of the invaded host. In general, it may be said that the virus purified by filtration or centrifugation so as to be concentrated quite apart from living bacteria, can be grown only on cultures of living tissue from a susceptible animal or on such embryonic tissue as the allantoic membrane of a chick's egg, and on no medium composed of non-living material such as is used for bacteria. Further the invasion and spread in the tissues of a susceptible animal allows of a very great increase in the virus. This results, as with the long-recognized bacterial infections, in the development in the animal body of antibodies, agglutinins, precipitins, etc. The preliminary injection of such immune serum from an animal which has recovered from a virus infection will prevent the invasion of the virus in a non-immune, inoculated animal but will not neutralize a virus already injected, because, as it is thought, the virus takes an intracellular position and is no longer exposed to the action of the immune bodies.

So far, then, the viruses in producing disease resemble pathogenic bacteria in their invasion of the body and in their production, in addition to the injuries which they cause, of a response on the part of the body in the formation of antibodies. They differ from bacteria in being dependent for their own reproduction on living cells in which they assume an intracellular protected position, and this suggests that they are dependent upon the cell for the production of something, probably of a protein nature, which they require for their nutrition and multiplication.

The diseases produced by viruses are very numerous and there can be mentioned here only types such as the tobacco mosaic in plants, psittacosis in parrots, encephalomyelitis in horses and encephalitis, poliomyelitis, influenza, measles, herpes and others in human beings.

Emphasis should be laid especially on one point which is commonly set aside, namely, the extraordinary predisposition to bacterial infection which results from the virus infection. Thus in an epidemic of measles in 1918, the deaths which occurred in great numbers were not due to the measles but to a secondary bacterial infection with a streptococcus. So, too, in the succeeding epidemic of influenza, the deaths were not due to the virus but to the following induced bacterial infec-

tion which varied in different parts of the country, sometimes streptococcus or pneumococcus or even staphylococcus, while in some places it was the haemophilus or Pfeiffer's influenza bacillus which had been erroneously believed to be the cause of influenza.

This relation has been particularly clearly studied by Shope in the case of influenza in swine, where the secondary invasion is what gives rise to the serious pathological changes.

In spite of the general understanding that scarlet fever is caused by a streptococcus, it is my belief that in this we have a typical virus infection with the characteristic secondary invasion of these bacteria. Of course, the immunological reactions which are regarded as distinctive of scarlet fever are readily explained as the effect of the secondary infection.

In many forms of virus disease the transmission from one person to another is by recognizable paths, such as the inhalation of infected spray from the breath of the diseased person, or by even more direct methods as by the bite of a dog with hydrophobia. But in many others, such as yellow fever and equine encephalomyelitis, there are intermediate hosts such as biting insects in which the virus is harbored for a long time and introduced with their bite. The control of such agencies of transmission and spread of the disease is of course of enormous importance as in the case of yellow fever.

Very important, too, is some comprehension of the conditions underlying the immunization of persons affected with such diseases. It is well known that the protection following vaccination against smallpox is of long duration and it is familiar that upon survival such childhood diseases as measles, scarlet fever, poliomyelitis and many others confer a lifelong immunity. Efforts toward artificial production of immunizing substances may depend upon various changes which can be brought about in the virus by inoculating it into less susceptible animals; thus the transfer of the yellow fever virus to mice results in the production of a type which invades the central nervous system. Most successful production of an immunizing substance has been produced by long-repeated culture of a virus in mouse embryo—Tyrode medium—and then in chick embryo. Such vaccination with a weakened virus seems to produce an effective immunization without any serious symptoms.

The principles of immunization are therefore similar to those applied in other infections, but the permanence of such immunity after recovery from the virus diseases is especially impressive. Andrewes emphasizes the persistence of viruses in the body with the antibodies which they have stirred into existence, and this may explain the prolonged immunity with apparent complete health, while disturbances of normal body conditions may temporarily diminish the im-

munity so that, as in herpes and some other diseases, the lesions produced by the virus may reappear.

The relation of viruses to the development of some tumors in animals has roused especial interest in recent years, and various papillomatous and other growths in rabbits have been described as well as extremely virulent and rapidly growing tumors in fowls, all of which can be transmitted to others by inoculation of filtered or otherwise isolated material from such growths. Rous and his associates have also found that the influence of tar rubbed on the skin is very effective in stirring the growth of a more malignant form of epithelial tumor growth after inoculation with the papilloma virus. Further studies of the part played by viruses in the production of tumors will be looked for in the future.

It is the extremely small size of the viruses which seems to offer the greatest difficulty in conceiving of their peculiar and specific activities such as might be more readily accepted in larger organisms. Thus in the case of the bacteriophages which are actually parasites, especially related to certain bacteria as hosts and invading their tiny bodies produce a ferment which causes the liquefaction or lysis of their bodies, setting free the bacteriophage to invade others. The story is a familiar one except that it is all on such a small scale, but the epidemic spread of this disease of the bacteria is like that of the diseases of large animals and seems to support surely the living character of these infinitesimal bacteriophages and their introduction from some source to the liquid medium in which the bacteria were alive, causing their death and destruction.

The intracellular growth of the viruses which makes them insensitive to immunizing antibodies injected later is of great interest. The nature of the inclusion

bodies found within the cells in some such diseases has never been thoroughly cleared, but the general idea is that they represent accumulations of the virus. The dependence of viruses upon living cells for their multiplication and growth has led to the idea that they must find or produce within these cells some nutritive substance required by them for their maintenance. Thus in the case of tobacco mosaic there is produced by the infection a quantity of a very heavy molecular protein which is the virus. Stanley has isolated this protein and has even crystallized it, proving by all the methods at his command that these crystals of the heavy protein molecule are not merely contaminated with the virus but that they are in themselves the virulent agent.

The question then arises as to the chemical character of other viruses and as to the nature of the factors required in a protein to give it the power of causing a destructive disease, stirring immunological reactions and perhaps especially its power of reproducing itself and multiplying to such extremes at the expense of its host. We have tacitly assumed all this to be the generally accepted character of a living being, and the problem left is perhaps only as to the chemical limitations of living as contrasted with non-living proteins. If only the chemical structure of proteins were not so infinitely complex it would be interesting to reconstruct this heavy protein synthetically and having reached its precise constitution to see whether it had any virus character although synthesized from pure materials which had never had any contact with tobacco plants. As Stanley says, certain compounds act as hormones, others as enzymes, others on injection stir up an anaphylactic reaction—the transitions to those activities which we regard as characteristic of life are not insuperable.

OBITUARY

ADRIAN JOHN PIETERS

DR. ADRIAN JOHN PIETERS, botanist, agronomist and administrator in the Department of Agriculture for nearly half a century, and world authority on forage and soil-conserving crops, died in Washington April 25 in his seventy-fourth year. Known, in recent years, as the Father of Lespedeza because of his apostolic leadership in making that soil-building legume a major crop in the South, Dr. Pieters had a part in a large number of the more significant contributions of plant science to agriculture during the past forty years. In his position as chief of the Office of Seed and Plant Introduction and Distribution he was one of the small group of able men who, in 1901, founded the Bureau of Plant Industry. Subsequently, as head of the section of Clover Investigations and of the Division of Forage Crops and Diseases, and as member of innum-

erable committees handling matters of Bureau policy, he had a large share in shaping the destinies of that Bureau and, correlatively, of applied plant science throughout the nation. The personalities, the ideas and the ideals of those who thus "set other minds in straight channels" are worth a moment's thought.

Dr. Pieters came to the science of agronomy when that earthy infant was in swaddling clothes. Its garments were sometimes of poor quality and often did not fit. Following horticulture, it was in the process of developing from an art to something approaching a science. Its devotees, of necessity, were mostly men of the soil who, on a foundation of hard realism, had to build a structure that would command the respect of eruditionists. There were not lacking those who scoffed.

Into this situation, in 1895, came a young graduate of

the University of Michigan, trained in biology but with an omnivorous mind. Among other interests which he had or later cultivated were history, literature, farming, languages, jurisprudence, business, bibliography, theology and medicine, in each of which diverse fields he was to become uncommonly well-informed. Nor did he regard these accomplishments lightly. Learning, to him, was not merely a pastime, still less a soporific. It was a live, keen-edged tool made for use. Thus it became his conscious habit to bring to bear on each daily problem different facets of his mind. It might be a proposed law governing the importation of seeds, ergo he considered it with a wide knowledge of its political, economic, legal, historical and biological implications. Even if the problem were of a kind not usually associated with broad culture, as for example—experimental technique, he could see it often from points of view not available to others. Naturally, he had his deficiencies and these he ruefully acknowledged, often lamenting his lack of interest in mathematics, sports, the fine arts and night clubs. Yet certainly he came close to being an intellectual giant simply from the profundity of his general knowledge.

Knowledge alone would not, however, suffice to make him a counselor of high worth. Perhaps from his Dutch ancestry, perhaps because it was an innate personal trait, he possessed a judicial attitude of truly extraordinary quality. He would have been an incomparable jurist. Few men could see more objectively. Fewer still could exercise the faculty with such complete indifference to the consequences to themselves. No single instance comes to mind when he compromised a solution because of its effect upon his personal welfare. If his decision affected others adversely, he made numberless concessions, but never to himself. Mental integrity, as personal integrity, was to him the cornerstone of character, and his scorn of devious thinking, as of devious intent, was quiet but complete.

Thus there was brought to agronomy at a time when it needed dignity, poise and learning a man who personified those attributes. He helped to give the neophyte science distinction, and lived, fortunately, far into its consummation.

Dr. Pieters' cultural contribution to agronomy was incidental, and probably unconscious. His real contribution was to the economic betterment of American farmers. Following a successful organization of what later became the Department and Congressional seed and plant distribution services, he resigned, in 1906, to organize a seed-producing business in California. Four years later he sold the business at a profit and, after a year at Heidelberg, returned to the University of Michigan for his doctorate. At the request of the late C. V. Piper he reentered the Department in 1915 to study the causes of wide-spread failure of the clover crop. Within a few years he had determined that the

chief cause of failure was unadapted seed, and he was instrumental in causing restrictions to be placed on the importation of unsuitable kinds. Later he turned his attention to the problem of finding legumes suited to growing on the impoverished acid soils of the South. This led to one of the dramatic finds for which the Bureau of Plant Industry is known. In a small packet of seed laid aside some time before, he found a new kind of *Lespedeza* from Korea which, when planted at Arlington Farm, developed such superior qualities that it became, in seventeen years, the basis of a *Lespedeza* industry rivaling that of clover and alfalfa combined.

He retired, at the compulsory age limit, in 1936, but was accorded the unusual distinction of two presidential extensions of appointment in order that the Bureau of Plant Industry and the Soil Conservation Service might utilize his knowledge.

Dr. Pieters was a fluent but precise writer, and his publications, which number more than eighty titles, are a true cross-section of forage crops, green manuring, and seed production. His unpublished counsels, his delightful wit, his unfailing tolerance, his devotion to truth, his unflagging energy, and his fine, inborn courtesy are in the Department's archive of memories.

L. W. KEPHART

U. S. DEPARTMENT OF AGRICULTURE

DR. ERKKI MIKKOLA

ON February 13, 1940, Dr. Erkki Mikael Mikkola, geologist of the Geological Survey of Finland, was killed at Taipale in the defense of his country against invasion. Although only 36 years of age, he had become a leader in the study of Pre-Cambrian problems. His published contributions to the understanding of the complex crystalline rocks of Finland are of fundamental value.

Erkki Mikkola's death is a genuine loss to science. His death is also a human example, for it came on the battlefield in a heroic attempt to protect his people from the invader. Finally, his death is a national symbol, for it represents the bravery and courage of a people who love their independence and their free institutions so much that they willingly give their lives for them.

On January 29, during the time of the fierce and unrelenting attacks at Taipale, Dr. Mikkola wrote a letter to his wife, in which he spoke of his hopes for their two-year-old only son, Tapani. It expresses so well the desperate desire of the Finnish people for freedom to pursue their cherished culture that I quote from it, through a translation made by Dr. Pentti Eskola, internationally known petrologist and, with the writer, a warm friend and admirer of Mikkola:

I have just been intensely imagining in my mind Tapani's undertakings and progress of speech, about which you wrote me so much, and I have recollected, among other things, how he almost filled a box with heavy

rock specimens and again placed most of them on the floor that time when you were finishing the drawing of the microscopic thin section. And how he pronounced to his father the new words he had learned when we met last time. My last wish is that the young life of my only dear son be protected by all means and that care be taken of his education in the community with western civilization, in freedom of human spirit, in knowledge and appreciation of all our common values and his Finnish descent, and in consciousness of his father's life ideals and aims. Profession and so-called social standing, again are altogether matters of minor importance. I sometimes feel that the fate of our country in the immediate future is at stake to such a degree that our whole nation may have to suffer incomparably graver misfortunes and that great numbers of our most helpless citizens must emigrate to foreign countries, as Finnish children have already been sent over to Sweden. But even in such a case we believe in the final preservation and progress of our country and the victory of the western countries and above all upon the victory of western civilization, which honors the individuality of man and the freedom of action and thought. If God allows, and wonderful opportunities or some quick favorable series of events come to our aid, we may clear with lesser sacrifices, but we should be infinitely thankful to the Highest, if we need not lose many times more than up to present date. The widowed women of our people may in that case only with pride remember their beloved ones who were asked to give their life for this great cause. And if our Tapani some day, as a grown-up man, be asked to do the same, then his father, either living or in the grave, will be glad to make this sacrifice, though now there exists nothing to which he is more ready than to give his own life to protect the little man's life from any imminent danger.

RICHARD FOSTER FLINT

YALE UNIVERSITY

RECENT DEATHS

DR. J. ANDREW DRUSHEL, since 1928 professor of education at New York University, previously for two years associate professor of mathematics, died on June 20. He was sixty-seven years old.

SIR ARTHUR HARDEN, professor of biochemistry, emeritus, at the University of London, died on June 17. He was seventy-five years old.

DR. JOHN GERALD FITZGERALD, professor of hygiene and preventive medicine at the University of Toronto and director of the School of Hygiene and of the Connaught Laboratories, died on June 20 at the age of fifty-seven years.

DR. W. E. HARPER, director of the Dominion Astrophysical Observatory at Victoria, B. C., died on June 4 at the age of sixty-two years. A correspondent writes: "In 1938 Dr. Harper attended the Stockholm meeting of the International Astronomical Union, and while crossing from Denmark to Germany was stricken with pneumonia. After spending six weeks in a hospital at Rostock he was taken to England and subsequently reached Canada in October, 1938. He never completely recovered from this serious illness; heart trouble followed with complications, which resulted in his death last week. Dr. Harper succeeded Dr. J. S. Plaskett in 1935, and during his short five-year directorship the work of the institution was pushed forward with vigor, with an increased staff and some additional equipment. His own contributions in the field of radial velocities, parallaxes and spectrographic binaries will long remain a memorial to his industry as a research worker."

SCIENTIFIC EVENTS

NATIONAL RESEARCH FELLOWSHIPS IN THE NATURAL SCIENCES

THE National Research Fellowship Board in the Natural Sciences, of the National Research Council, has made the following fellowship appointments for the academic year 1940-1941:

John Nathaniel Adkins, Ph.D. in seismology, University of California, 1939. To work at Massachusetts Institute of Technology. Subject: Deformation of the earth under the action of ice loads and tidal forces.

Daniel I. Axelrod, Ph.D. in tertiary paleobotany, University of California, 1938. To work at the United States National Museum, Washington, D. C. Subject: The later Tertiary floras of California (with particular reference to criteria for age determination).

Herbert Irving Bernstein, Ph.D. in chemistry, Pennsylvania State College, 1940. To work at Princeton University. Subject: A stereochemical approach to the problem of molecular rearrangements.

Albert Patrick Blair, Ph.D. in zoology, Indiana University, 1940. To work at Columbia University. Subject: Interrelations of the toads of eastern North America.

Robert Harza Burris, Ph.D. in agricultural bacteriology, University of Wisconsin, 1940. To work at Columbia University. Subject: Biological nitrogen fixation with the aid of isotopic nitrogen.

Robert Avery Chipman, Ph.D. in physics, University of Cambridge, 1939. To work at the Johns Hopkins University. Subject: Methods of electrical measurements and the electrical properties of matter at very high radio frequencies.

Charles Louis Critchfield, Ph.D. in theoretical physics, George Washington University, 1939. To work at Princeton University. Subject: Forces between elementary particles.

Max Demorest, Ph.D. in geology, Princeton University, 1938. To work at Yale University. Subject: The structural petrology of ice.

Richard Wolford Dodson, Ph.D. in chemistry, the Johns

Hopkins University, 1939. To work at California Institute of Technology. Subject: Radiochemical study of the products of the neutron-induced fission of uranium and thorium nuclei.

Arthur John Dziemian, Ph.D. in physiology, Princeton University, 1939. To work at University of Pennsylvania. Subject: The effects of changing the chemical constitution of the erythrocyte on its permeability.

Ralph Stanley Halford, Ph.D. in chemistry, University of California, 1938. To work at Harvard University. Subject: Thermodynamic properties of solutions and their relations to the kinetics of chemical reactions therein.

Felix Webster McBryde, Ph.D. in geography, University of California, 1940. To work at the University of California Experiment Station. Subject: Detailed survey of native crops and agricultural practices in the north Middle American region.

Walter John Moore, Jr., Ph.D. in chemistry, Princeton University, 1940. To work at California Institute of Technology. Subject: The crystal structure of tripeptides.

Harry Townsend Muhly, Ph.D. in mathematics, the Johns Hopkins University, 1940. To work at Princeton University. Subject: The theory of the singularities of algebraic varieties.

Jack Edgar Myers, Ph.D. in botany, University of Minnesota, 1939. To work at the Smithsonian Institution, Washington, D. C. Subject: A comparison of the photosynthetic behavior of several types of plants.

Myron Hiram Nichols, Ph.D. in physics, Massachusetts Institute of Technology, 1939. To work at Princeton University. Subject: Thermionic properties of the various crystal faces of tungsten.

Darrell Wayne Osborne, Ph.D. in physical chemistry, California Institute of Technology, 1938. To work at the University of California. Subject: Rotation of methyl groups in metal alkyls by measurement of entropies.

Daniel Chapin Pease, Ph.D. in experimental embryology, Princeton University, 1940. To work at Stanford University. Subject: Determination of the bilateral axis of echinoderm eggs (*Dendraster*).

John Robert Raper, Ph.D. in general biology, Harvard University, 1939. To work at the California Institute of Technology. Subject: The sexual mechanism in the Saprolegniales.

Carl Keenan Seyfert, Ph.D. in astronomy, Harvard University, 1936. To work at Mount Wilson Observatory. Subject: The detection and study of emission nebulae in spirals.

Claude Elwood Shannon, Ph.D. in mathematics, Massachusetts Institute of Technology, 1940. To work at the Institute for Advanced Study. Subject: A non-associative algebra applicable to dynamics of Mendelian populations.

Henry Keith Townes, Jr., Ph.D. in systematic entomology, Cornell University, 1937. To work at the Academy of Natural Sciences of Philadelphia. Subject: A catalogue of the ichneumon flies of America north of Mexico with new synonymy from a study of the types.

George E. Valley, Jr., Ph.D. in physics, University of Rochester, 1939. To work at Harvard University. Subject: Gamma radiation spectra.

Stanley Wawzonek, Ph.D. in organic chemistry, University of Minnesota, 1939. To work at the University of Illinois. Subject: The synthesis of Cyclooctatetraene.

THE WASHINGTON HEIGHTS HEALTH AND TEACHING CENTER

DEDICATION ceremonies of the Washington Heights Health and Teaching Center, New York City, a seven-story building at the southwest corner of 168th Street and Broadway, were held on June 10. Mayor Fiorello H. La Guardia made the principal address, and Health Commissioner John L. Rice presided. This is the eleventh new health center building completed under the present administration and the fifth and final unit in New York City's health and teaching program being carried forward in cooperation with the five medical schools of the city and the Department of Health.

The new building was constructed with city funds under supervision of the Department of Public Works at an approximate cost of \$400,000. The brick and stone construction is of an architectural design which harmonizes with the adjoining Columbia-Presbyterian Medical Center buildings. James Gamble Rogers was the architect. Presbyterian Hospital made available the land for the new building, which on its fifth, sixth and seventh floors houses the DeLamar Institute of Public Health of the College of Physicians and Surgeons of the university.

In addition to the mayor and health commissioner, speakers at the ceremony were William Hale Harkness, vice-president of Presbyterian Hospital, who represented Dr. Nicholas Murray Butler, president of Columbia University, who was unable to be present, and Dr. Nathan B. Van Etten, president-elect of the American Medical Association, which opened its annual meeting in New York on June 10. Participants also included Dr. Willard C. Rappleye, dean of the College of Physicians and Surgeons, the cooperating medical school; Dr. Haven Emerson, professor of public health at Columbia; Frederick Guggenheimer, executive director of the City Affairs Committee of New York, who is chairman of the Washington Heights-Riverside District Health Committee, and Dean Sage, president of the Board of Managers of Presbyterian Hospital.

Following the dedication program, a reception and tour of the new building was held. Approximately 200 representatives of the university and the medical school, community health, welfare and civic leaders, public officials and officers and delegates to the American Medical Association convention attended.

In addition to the Washington Heights Health and Teaching Center, where the training program is in cooperation with the College of Physicians and Surgeons of Columbia University, similar cooperative arrangements obtain in the following new health and

teaching centers: Lower East Side with New York University College of Medicine; Kips Bay-Yorkville with New York Hospital-Cornell University Medical College; East Harlem with New York Medical College and Flower Hospital, and Red Hook-Gowanus with Long Island College of Medicine.

Three additional new health centers are planned for completion this summer and fall, namely, the Corona Health Center in Queens, the Tremont Health Center and Borough Office Building in the Bronx and the Fort Greene Health Center and Borough Office Building in Brooklyn. Plans are also under way and funds have been provided in the budget of the Department of Health for a new health center and borough office building in Jamaica, Queens. When these units are completed, New York City will have fifteen new health center buildings in the five boroughs, or half the goal set for establishing a health center in each of the city's thirty health center districts.

NOMINATIONS FOR OFFICERS OF THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS

NOMINATIONS for officers for 1941 of the American Society of Mechanical Engineers have been announced. O. A. Leutwiler, head of the department of mechanical engineering at the University of Illinois, is chairman of the National Nominating Committee, which held sessions during the semi-annual meeting of the society in New York City from June 17 to 20. Election will be held by letter ballot of the entire membership of 15,000, closing on September 24.

The nominees as presented by the committee are:

President, William A. Hanley, in charge of engineering, Eli Lilly and Company, Indianapolis.

Vice-presidents, Dean Samuel B. Earle, School of Engineering, Clemson Agricultural College, South Carolina; Frank H. Prouty, partner, Prouty Bros. Engineering Company, Denver; Edwin B. Ricketts, mechanical engineer, Consolidated Edison Company of New York, Inc.

Managers, Professor Huber O. Croft, head of the department of mechanical engineering, the State University of Iowa; Professor Paul B. Eaton, in charge of the department of mechanical engineering, Lafayette College; George E. Hulse, chief engineer, Safety Car Heating and Lighting Company, New Haven.

PROMOTIONS AND APPOINTMENTS AT THE ROCKEFELLER INSTITUTE FOR MEDICAL RESEARCH

THE Board of Scientific Directors of the Rocke-

feller Institute for Medical Research announces the following appointments and promotions on the scientific staff to take effect on or after July 1.

Promotions: Associate Member to Member. Dr. Duncan A. MacInnes, Dr. Richard E. Shope, Dr. Wendell M. Stanley.

Associate to Associate Member. Dr. Moses Kunitz, Dr. Alfred E. Mirsky.

Assistant to Associate. Dr. Douglas A. MacFadyen, Dr. William Trager.

Fellow to Assistant. Dr. Armin C. Braun, Dr. Malcolm S. Ferguson, Dr. Birdsey Renshaw, Dr. William C. Spring, Jr.

New Appointments: Assistants. Dr. Gail L. Miller, Dr. Howard A. Schneider, Dr. Armine T. Wilson.

Fellows. Dr. James A. Baker, Claude A. Knight, Jr., Dr. Kermit W. Kreitlow, Dr. Margaret R. McDonald, Dr. R. Walter Schlesinger.

The board also announces that Dr. Leonor Michaelis, who has reached the age of retirement, has been made member emeritus of the institute.

HONORARY DEGREES CONFERRED BY HARVARD UNIVERSITY

AT the two hundred and eighty-ninth commencement on June 20 of Harvard University ten honorary degrees were conferred. Dr. James Bryant Conant, president of the university, read the citations. Those conferred in the sciences were as follows:

DOCTOR OF LAWS

Julian L. Coolidge, professor of mathematics, LL.D.—The first master of Lowell House, one of the founding fathers of a new era in collegiate education, magnanimous in his friendships, resolute in his labors.

DOCTOR OF SCIENCE

Alfred N. Richards, professor of pharmacology, University of Pennsylvania, D.S.—An ingenious experimenter with living animals, a learned student of the action of drugs in alleviating human suffering.

Thomas Barbour, director of the Harvard University Museum, D.S.—A born naturalist, who has extended our vision of the age-old world of animal life; a generous leader, an able director of a great museum.

Elliott P. Joslin, clinical professor of medicine, emeritus, D.S.—A pioneer in applying scientific knowledge to the treatment of diabetes; to his hospital have come a multitude of physicians eager to improve their skill.

SCIENTIFIC NOTES AND NEWS

MEMBERS of the new National Defense Research Committee instituted by President Roosevelt have been appointed as follows: Dr. Vannevar Bush, president of the Carnegie Institution of Washington,

chairman; Dr. Frank B. Jewett, president of the National Academy of Sciences and president of the Bell Telephone Laboratories; Dr. Lyman J. Briggs, director of the National Bureau of Standards; Presi-

dent James B. Conant, of Harvard University; President Karl T. Compton, of the Massachusetts Institute of Technology; Dr. Richard C. Tolman, of the California Institute of Technology; Commissioner of Patents Coe, representing the Department of Commerce, and representatives of the War and Navy Departments.

DR. PETER J. W. DEBYE, of the Kaiser Wilhelm Institute of Physics at Berlin-Dahlem, Nobel laureate in chemistry in 1936, has been appointed professor and chairman of the department of chemistry at Cornell University. Dr. Debye has been George F. Baker visiting lecturer in chemistry at Cornell University during the past term. His son, Peter Paul Debye, will be associated with Professor Debye in research in the Baker Laboratory of Chemistry at Cornell. Professor Jacob Papish, who has been chairman of the department, will continue as vice-chairman.

PROFESSOR OTTO LOEWI, who was awarded the Nobel Prize in medicine in 1936, has become research professor in pharmacology at the New York University College of Medicine.

At the commencement exercises on June 9 of Yale University the degree of doctor of science was awarded to Dr. Edward Adelbert Doisy, professor of biochemistry at St. Louis University. The citation made by President Seymour reads: "For your brilliant investigations in the chemistry of vital processes which have led to the isolation and synthesis of chemical compounds important for human life, thus contributing to the conservation of health and the prevention of disease."

DR. WARDER CLYDE ALLEE, professor of zoology at the University of Chicago, on June 10 received the honorary degree of doctor of laws from Earlham College, Richmond, Ind. The citation reads: "He is a scholar who believes that scholarship should serve society, a scientist and an author who seeks to apply natural laws to the social, the economic and the spiritual world." Dr. Allee has been elected an alumni trustee of the college.

At the commencement exercises on June 6 of Wesleyan University the degree of doctor of science was conferred on Dr. Frank Burnett Dains, professor of chemistry at the University of Kansas, and on Dr. Lewis Gardner Westgate, professor emeritus of geology of the Ohio Wesleyan University.

THE degree of doctor of laws was conferred on Professor Maria M. Roberts by the Iowa State College on June 10, "in recognition of fifty years of devoted and distinguished service to the college in the department of mathematics, as dean of the Junior College and as administrator of the student loan funds."

THE degree of doctor of science was conferred on Dr. Melville Thurston Cook, director of the Insular Experiment Station at Rio Piedras, at the graduating exercises of the College of Agriculture and Mechanic Arts of the University of Puerto Rico, at Mayaguez, in recognition of his work in tropical plant pathology. Dr. Cook delivered the commencement address.

MEMBERS of the staff of the State Education Department and the Regents of the University of the State of New York gave a testimonial dinner on June 18 in the Education Building in honor of Dr. Frank P. Graves, State Commissioner of Education, who will retire on July 1. An oil painting of Dr. Graves, which will be hung in the main corridor of the Education Building, was unveiled at the dinner.

MRS. EDITH H. QUIMBY, associate physicist of Memorial Hospital for the Treatment of Cancer and Allied Diseases, New York, was presented with the Janeway Medal for distinguished service in radiological physics of the American Radium Society at the twenty-fifth annual dinner of the society at the Waldorf-Astoria on June 6.

OFFICERS of the American Society of Plant Physiologists elected for the year beginning on July 1 are: F. P. Cullinan, Beltsville, Md., *president*; B. S. Meyer, the Ohio State University, *vice-president*; J. W. Shive, New Jersey Agricultural Experiment Station, member of the executive committee, and H. R. Kraybill, Purdue University, member of the editorial board of *Plant Physiology*. W. E. Loomis, of the Iowa State College, will continue as *secretary-treasurer*.

DR. EDWARD ELLERY, professor of chemistry of Union College, gave the address at the commencement exercises of the college. He is retiring at the close of the year after thirty-six years of service as professor. He has been successively dean of the faculty, acting president, chairman of the faculty and of the division of science. On July 1 he will become national president of Sigma Xi, of which he has been executive secretary for eighteen years.

DR. WILLIAM E. HENDERSON, professor of chemistry, and Dr. Edwin F. Coddington, professor of geodetic engineering, of the Ohio State University, are retiring with the title emeritus at the close of the academic year.

DR. JOSEPH ALLEN, professor of mathematics at the College of the City of New York, a member of the faculty since 1897, will retire on September 1.

DR. BURTON D. MYERS, dean of the Indiana University School of Medicine at Bloomington, will retire at the end of the current semester. He has been affiliated with the school since 1903, when he was made

professor of anatomy. The retirement is also announced of the following part-time members of the medical and dental faculty: Dr. Alois B. Graham, chairman of the division of gastro-enterology and professor of surgery; Dr. Charles E. Cottingham, associate in neurology and psychiatry; Dr. John Tipton Wheeler, professor of anatomy at the dental school, and Dr. Louis DeKeyser Belden, associate professor of pathology, bacteriology and histology.

PROFESSOR E. S. HABER has been named head of the vegetable crops subsection of the Iowa Agricultural Experiment Station. He succeeds Professor A. T. Erwin, who continues to be a member of the staff. Professor Haber has been at the Iowa State College since 1920, both as member of the Experiment Station and of the department of horticulture.

DR. J. HOLMES MARTIN, director of the U. S. Regional Poultry Research Laboratory of East Lansing, Michigan, has been appointed head of the poultry department at Purdue University effective on July 1. Dr. Martin was in charge of poultry husbandry and genetics at the University of Kentucky before going to the Bureau of Animal Industry in January, 1939. Professor C. W. Carriek, who has been serving as head of the department at Purdue, has, at his own request, been relieved of administrative work, so that he may give his undivided time to research and teaching.

DR. BRYCE L. CRAWFORD, JR., instructor at Yale University, has been appointed assistant professor of physical chemistry at the University of Minnesota.

DR. L. P. ALFORD, chairman of the department of administrative engineering at New York University, has not joined the faculty of Cornell University as was erroneously stated in the issue of *SCIENCE* for May 24.

DR. GEORGE WALTER MCCOY, professor of preventive medicine and public health at the Louisiana State University School of Medicine, New Orleans, will retire from the U. S. Public Health Service on June 30 after forty years of active service.

NEWTON B. DRURY, of California, has been appointed director of the National Park Service to succeed Arno B. Cammerer, who in accordance with his request will be relieved for reasons of health. Mr. Cammerer will remain with the National Park Service and will be appointed to an advisory position.

DR. A. C. SMITH, associate curator of the New York Botanical Garden, has been appointed curator of the Arnold Arboretum of Harvard University at Jamaica Plain.

PROFESSOR A. M. CHICKERING of Albion College, will spend several weeks during the coming summer at

the Museum of Comparative Zoology of Harvard College working on his extensive collections of spiders made as a result of five summers of field work in Panama and Honduras.

PROFESSOR CARL F. CORI, of the department of pharmacology, Washington University School of Medicine, lectured at the Iowa State College on June 21. His subject was "Enzymatic Synthesis of Carbohydrates."

DR. KARL T. COMPTON, president of the Massachusetts Institute of Technology, gave the commencement address at Wellesley College on June 17.

THE Genetics Society of America will hold its usual meeting at the Marine Biological Laboratory, Woods Hole, Mass., on Thursday and Friday, on August 29 and 30.

SIGMA PI SIGMA, physics honor society, recently installed new chapters at the San Diego State College, California, and at Muskingum College, New Concord, Ohio. On May 23 Dr. Carl F. Eyring, dean of the College of Arts and Sciences of Brigham Young University, installed the San Diego State College chapter. Thirty-three students, faculty members and alumni constituted the charter group. At an open meeting following the installation banquet, Dr. Vern O. Knudsen, dean of the Graduate Division of the University of California at Los Angeles, delivered an address on "An Ear to the Future." The Muskingum College Chapter was installed on May 31, with Dr. Marsh W. White, Pennsylvania State College, as senior installing officer, assisted by a number of alumni members of the society. Dr. Elmer Hutchisson, head of the department of physics at the University of Pittsburgh, addressed an open meeting in the evening, speaking on "Robots Return to Reason," and presenting an appeal for a new and more effective approach to the teaching of physics to non-technical students.

A NEW department of psychology has been established in the College of Arts and Sciences at the University of Nebraska, with Dr. Arthur Jenness, associate professor of psychology, as chairman. The psychological laboratory at Nebraska has existed since 1889, but until now it has been a part of the department of philosophy and psychology. The staff of the new department, in addition to Dr. Jenness, consists of Dr. Donald W. Dysinger, assistant professor, Dr. William E. Walton, assistant professor, Dr. Wilbur S. Gregory, instructor, and Dr. Roger W. Russell, instructor. No change has been made in the department of educational psychology and measurements in the Teachers College or in the work in child development and family life in the department of home economics in the College of Agriculture.

THE *Journal* of the American Medical Association

states that the division of medical sciences of the National Research Council has appointed the following committees to cooperate with the medical corps of the U. S. Army and Navy: *Committee on Chemotherapeutic and Other Agents*: Dr. Perrin H. Long, *chairman*, Baltimore; Dr. Francis G. Blake, New Haven; Dr. John S. Lockwood, Philadelphia; Dr. John F. Mahoney, Staten Island, N. Y.; Dr. Eli Kennerly Marshall, Jr., Baltimore. *Subcommittees*: Infectious Diseases, Dr. Blake, *chairman*; Tropical Diseases, Dr. Wilbur A. Sawyer, New York, *chairman*; Venereal

Diseases, Dr. Joseph E. Moore, Baltimore, *chairman*; Wounds and Burns, Dr. Evarts A. Graham, St. Louis, *chairman*. *Committee on Transfusions*: Dr. Walter B. Cannon, Boston, *chairman*; Dr. Alfred Blalock, Nashville, Tenn.; Dr. Everett D. Plass, Iowa City; Dr. Max M. Strumia, Bryn Mawr, Pa.; Dr. Cyrus C. Sturgis, Ann Arbor. *Subcommittees*: Blood Substitutes, Dr. Sturgis, *chairman*; Anesthesia in Shock, Dr. Blalock, *chairman*. These committees are the result of an informal request for advice from the two medical corps.

DISCUSSION

THE RELATIONSHIP OF HISTAMINE TO ANAPHYLAXIS IN THE RABBIT

The long-suspected possibility that histamine might play a rôle in the symptomatology of acute anaphylaxis in experimental animals was demonstrated by Dragstedt and Gebauer-Fuelnegg¹ for the dog, and by Bartosch, Feldberg and Nagel² for the guinea-pig. The significant relationship of histamine to the reactions in these animals has been confirmed by a number of workers.³ The postulate of Dale that the effects of histamine are a prominent feature of the anaphylactic reaction has thus been verified for these animals. Recently Rose and Weil⁴ have reported that during anaphylactic shock in the rabbit there is a marked decrease in the total blood histamine in contrast to the increased amounts that are found in the dog and guinea-pig. This observation has been confirmed in our laboratory. This apparent discrepancy would not be disturbing to any general concept of the anaphylactic reaction, were it not for the fact that the symptomatology of the reaction in the rabbit bears the imprint of the effects of histamine nearly to the same extent that the reactions in the dog and guinea-pig do.

We believe that the following observations explain this apparent contradiction, and indicate that histamine does indeed play a rôle in the reaction in the rabbit.

Of the rabbit's tissues, blood is one of the richest sources of histamine, and Code⁵ has shown that the greater part of this is contained within the leukocytes. Leukopenia is a common manifestation of anaphylaxis in many animals, and is particularly striking in the rabbit. Abell and Schenck⁶ have shown that during

an anaphylactic reaction in a rabbit, the leukocytes become sticky, adhering in clumps to the endothelium of the smaller vessels and actually form leukocytic emboli, which may completely obstruct some of these vessels. A rapid reduction in the leukocytes would necessarily result in a reduction in the histamine content of the circulating blood unless histamine from other sources was added in quantities to compensate for such a loss. Since the lungs would provide the first filter for sticky leukocytes in an anaphylactic experiment when the antigen is injected intravenously, the following experiment was performed. A sensitized rabbit was killed and the lungs arranged for perfusion through the pulmonary vessels and for rhythmical ventilation through the trachea. The animal's blood was obtained, kept from clotting by means of heparin, and perfused through the lungs. Histamine determinations and leukocyte counts were made on the blood during several passages through the lungs. Antigen was then added to the blood and the determinations repeated. There was a marked reduction in the total blood histamine and in the leukocyte count after the first passage through the lungs following the addition of antigen, amounting to approximately 50 per cent. of the preceding values. Continued perfusion resulted in a still further reduction.

These observations explain why the total blood histamine is reduced in rabbits during anaphylactic shock. The question remains—does histamine play a rôle in the anaphylactic reaction? Katz⁷ has shown that if antigen is added to blood from a sensitized rabbit, there is a release of a considerable fraction of the cellular histamine into the plasma. We have confirmed this observation. On the basis of the *in vitro* experiment, the calculated amount of histamine that could be liberated *in vivo* is in the neighborhood of 0.1 to 0.3 mgm of histamine base per kilo. Such a dose of histamine would undoubtedly produce marked effects. That histamine is released *in vivo* as it is *in vitro* is indicated by Abell and Schenck's observations

¹ C. A. Dragstedt and E. Gebauer-Fuelnegg, *Am. Jour. Physiol.*, 102: 512, 520, 1932.

² R. Bartosch, W. Feldberg and E. Nagel, *Pflüger's Arch.*, 230: 129, 674, 1932.

³ C. A. Dragstedt and F. B. Mead, *Jour. Pharm. and Exp. Ther.*, 57: 419, 1936; G. Unger and J. L. Parrott, *Ann. de Physiol.*, 13: 939, 1937; C. F. Code, *Am. Jour. Physiol.*, 123: 40, 1938.

⁴ B. Rose and P. Weil, *Proc. Soc. Exp. Biol. and Med.*, 42: 494, 1939.

⁵ C. F. Code, *Jour. Physiol.*, 90: 485, 1937.

⁶ R. G. Abell and H. P. Schenck, *Jour. Immunol.*, 34: 195, 1938.

⁷ G. Katz, *SCIENCE*, 91: 221, 1940.

of a marked arteriolar contraction during anaphylaxis in the rabbit and by Rose and Weil's observations that an actual increase in plasma histamine can sometimes be detected. That the increase in plasma histamine in the intact animal is not more marked than it is, is probably due to the rapidity with which histamine is removed from the circulating blood. There is undoubtedly some release of histamine from other tissues as well as blood cells during anaphylaxis in the rabbit. We have been able to demonstrate this in the case of the lungs, using saline perfusion instead of blood. The amount that is liberated is quantitatively very small compared with that for the blood, however, so that it could not compensate for the histamine imprisoned with the leukocytes in the various capillary beds of the circulatory system.

There is substantial reason for believing, therefore, that histamine plays a significant rôle in the anaphylactic reaction in the rabbit, notwithstanding the fact that the total blood histamine value is reduced during the reaction.

CARL A. DRAGSTEDT
MAX RAMIREZ DE ARELLANO
ALFRED H. LAWTON

NORTHWESTERN UNIVERSITY
MEDICAL SCHOOL

THE UTILIZATION OF IRON BY ANEMIC RATS

IN the issue of *SCIENCE* for February 9, 1940, a paper appeared by Miss Louise Otis and Dr. Margaret Cammack Smith on "Further Evidence of Sex Variation in the Utilization of Iron by Anemic Rats." I would like to point out that the finding of these investigators was previously established by Dr. Helen J. Hubbell and reported in the *Journal of Nutrition*, January, 1938, Vol. 15, pp. 91-102. This paper seems to have been overlooked by Dr. Smith and Miss Otis. That there is a sex difference in the utilization of iron was first suggested by Dr. Helen S. Mitchell in 1932, and shortly afterwards this observation was confirmed by Rose and Kung. In 1938 the influence of sex was quantitatively investigated by Dr. Hubbell, who found about 12 per cent. more iron in the bodies of female than of male rats which had been depleted to about 4 gms of hemoglobin per 100 cc of blood, and then given equivalent dosages of iron per gram of body weight until their hemoglobin reached the level of 14 gms per 100 cc of blood.

MARY S. ROSE

TEACHERS COLLEGE
COLUMBIA UNIVERSITY

THE "BABOON BOY" OF SOUTH AFRICA¹

ON the basis of evidence which was at that time

¹ The writer is indebted to Dr. Raymond Dart, professor

believed to be accurate and complete, the writer gave a brief account² of Lucas, the so-called "baboon boy" of South Africa, who has at various times been described in the popular press. In addition to excerpts from newspaper accounts, the writer published the contents of a letter written by Lieutenant Colonel O. J. T. Horak, deputy commissioner of the South African police commanding Cape Eastern Division, in which hearsay evidence regarding the discovery of Lucas among baboons was reported. A statement made by Constable W. J. Coetzer was also reproduced, in which he described in detail the story of Lucas' reported capture as told to him in 1921 by ex-Lance Sergeant Venter (now deceased). A brief statement of 152 words by Lucas himself, made before Constable G. G. Wright on May 8, 1939, was also reproduced, the statement describing his (Lucas') previous animal-like existence among the baboons. It was also reported that Lucas had been captured and taken to the Mental Hospital by the police, and that inquiry to date had failed to reveal a record of previous admission.

Since the time of the initial report, however, largely through the efforts of Dr. Dru Drury, 120 High Street, Grahamstown, and Dr. J. A. van Heerden, the present physician-superintendent of the Grahamstown Mental Hospital, additional information has been discovered. Dr. Drury has been able to interview and to examine Lucas, and has communicated with every available person who might possibly have had knowledge of the case.

It is now revealed that Lucas was admitted to the Grahamstown Mental Hospital as an indoor pauper on March 30, 1904, nothing being known about him or his people. He was certified at Burghersdorp by Drs. Herbert Caiger and J. Tandy Bolger on February 19 and 20, respectively. Upon admission, he was described as a Kafir boy approximately thirteen years of age, and the cause of admission was described as "injury to the head." He was said to show a "foolish and nervous manner," and was "destructive to his clothes and dirty in habits." When admitted, he was emaciated, and was described as suffering from a previously fractured right tibia and as having a large semilunar indentation over the left side of the skull for about five inches from tip to tip which, Lucas claimed, was the result of a kick from an ostrich. He was diagnosed as "acute mania," but being "neither epileptic, suicidal, nor dangerous," he was discharged as recovered on June 15, 1904. No mention of the baboon story was made in the Mental Hospital records.

of anatomy, University of the Witwatersrand, Johannesburg, South Africa, for making available to him a copy of the documents and reports upon which this account is based.

² *Amer. Jour. Psychol.*, 53: 128-133, 1940; *SCIENCE*, 91 (2360): 291-292, 1940.

Thus a second and more plausible hypothesis regarding the boy's behavior would attribute the temporary "acute mania" to the injury in the region of Broca's area. Such an injury would especially account for his linguistic disabilities. The distance of Burghersdorp from Grahamstown, and the fact that there is no mention of the baboon incident in the hospital records, would likewise seem to discount the existence of a "feral" period in Lucas' life.

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FREEZING OF HOT AND COLD WATER

PROFESSOR THOMPSON¹ and his reply² to Professors Sanford, Lyon and Wakeham³ stimulated an interesting discussion on the basis for the belief that hot water freezes more quickly than cold. Additional variables have occurred to me which I believe would have a considerable bearing on the explanation of this problem, in addition to the thermal factors mentioned in the above articles.

The freezing rates of liquids depend not only on temperature and rates of heat transfer and mass, but also on the freezing-points of the liquids.

Heating certain samples of water expels dissolved gases, decomposes bicarbonates, precipitates compounds whose solubilities decrease with increase in temperature, etc. This lowers the concentration of dissolved matter, and consequently raises the freezing-point.

Then, if the external temperature is between the freezing-points of the heated and unheated samples, the "hot" water will not only freeze first, but will be the only one to freeze, regardless of all other circumstances. These conditions could have been fulfilled unwittingly many times by kettles of water (alike or unlike) and by hot and cold water in pipes.

Many of us have observed a similar phenomenon in opening a bottle of carbonated beverage which had been outdoors in freezing weather. The liquid is not frozen and doesn't freeze on shaking (probably not supercooled), yet when the cap is removed, the liquid may suddenly freeze solid or become mushy with ice

crystals. The temperature of the liquid was between the freezing-points of the liquid with and without the CO₂ lost by removing the cap.

Of course, even if the external temperature should be below the freezing-points of both the heated and unheated samples, occasional combinations of circumstances still might permit the heated sample to freeze first.

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I READ with great interest the letters in SCIENCE of April 19 under the title, "Roger Bacon Was Mistaken," and also Professor Thompson's recent letter. Whether it was Roger or Francis, here was a challenge:

The belief that hot water does freeze more quickly seems to be firmly ingrained in the public mind so that many persons believe if hot water is placed in the ice-cube compartment of an electric refrigerator it will freeze faster than if cold water is placed therein. Perhaps it will if a large portion of it is lost through evaporation.

I went so far as to try the experiment myself. I report my results without explanation, not in order to confuse but to illustrate how seldom we know all about any experiment. I reserve my explanation so as to present this picture-puzzle. What is wrong with it?

A liter of water at 0° C was placed in the usual aluminum tray of the refrigerator and left to freeze without interruption for 60 minutes. The water left unfrozen was then poured out and measured. The volume was 720 cc. Apparently 280 cc of water had been frozen at 0°.

Then I heated to boiling another liter of water, put it into the same aluminum tray and into the same refrigerator compartment and left it also undisturbed for 60 minutes. Then I removed it and found only about 600 cc of liquid water and 400 grams of ice, which I thawed out and measured. In other words, the hot water had frozen faster.

Was Bacon really mistaken?

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SCIENTIFIC BOOKS

THE HYPOTHALAMUS

The Hypothalamus and Central Levels of Autonomic Function. Research Publications of the Association for Research in Nervous and Mental Disease, vol 20. Edited by JOHN F. FULTON, S. WALTER RANSON and ANGUS M. FRANTZ. xxx+980 pp., 35 tables,

319 illustrations. Baltimore: Williams and Wilkins Company. \$10.00.

THE pituitary body, or hypophysis, has been termed the master gland of internal secretion. It is attached to a small eminence at the base of the brain, and these two structures comprise the hypothalamus. In the brain of a fish or a salamander this part may be much more than a thirtieth of the total bulk of the brain, but in a man it is only one tenth of that. This is

¹ SCIENCE, March 29.

² SCIENCE, May 24.

³ SCIENCE, April 19.

not due to shrinkage in relative importance of these organs in higher animals, but to the addition of other parts of the brain with different functions; for the hypothalamus in all these animals is the great central adjuster of some of our most fundamental vital processes. As Dr. Cushing expressed it, "Here in this well-concealed spot, almost to be covered by a thumb-nail, lies the very mainspring of primitive existence—vegetative, emotional, reproductive—on which, with more or less success, man has come to superimpose a cortex of inhibitions."

The most puzzling thing about this automatic visceral adjuster is its relation to that "cortex of inhibitions," because emotion, which may be consciously experienced and regulated, is under some measure of control by the cerebral cortex. The nature and mechanism of this cortical control have been studied in man by examination of cases where these functions are disturbed by injury or disease and in other animals by various experimental methods, including complete removal of the cortex and analysis of the remaining hypothalamic functions. The fishes and amphibians have no cortex to complicate the picture. Their very large hypothalamus has been well described anatomically, but the physiologists have so far neglected the opportunity here presented to investigate the intrinsic functions of the hypothalamus with minimal disturbance of normal relations.

Our useful knowledge about this puzzling region has been practically all acquired within the present generation. One of the first clinical symptoms associated with it is Fröhlich's syndrome, described in 1901, and Dr. Fröhlich remarked at the symposium here reported, "All we knew at that time was that the hypothalamus was an anatomical region lying beneath the thalamus." His memorable case report is quoted in full in Dr. Fulton's historical introduction to the volume here reviewed.

This is a notable book for several reasons besides the comprehensive scope and excellence of the researches reported. Confusion and mystery are here reduced to order and precision, not because all problems have been solved, but because critical analysis and systematization of existing knowledge are used as a basis for interpretation of known facts and reformulation of the problems. This report may therefore be regarded as a model which sets a standard of procedure in the cultivation of fields at the frontiers of knowledge. About two years before the symposium was presented detailed plans were formulated for its preparation. A confused terminology was systematized and the forty-two contributors cooperated to make the reform effective. Each of the thirty-four papers is a unit, with its own condensed bibliography, and at the end of the volume these citations (and some others) are assembled in a comprehensive bibliography

of 68 pages which is probably the most useful survey of the literature of the embryology, comparative anatomy, structure, functions and clinical significance of this enigmatic part of the brain. The book is not a mere digest of literature; it contains much new material; it is well indexed and is appropriately dedicated to Dr. S. W. Ranson, director of the Neurological Institute of Northwestern University. Following Dr. Fulton's introductory historical sketch, the work is divided into three parts, dealing with the anatomical, physiological and clinical aspects of the hypothalamus.

The first research by Dr. Papez on the embryological development is brief and clear. The second paper on comparative anatomy by Drs. Crosby and Woodburne (Chapter III) is the longest in the book (118 pages), including a comprehensive survey of the anatomy of this part of the brain in all vertebrates below mammals. Previously recorded work is reviewed, but the substance of this paper is original research by the authors based chiefly upon the Huber neurological collection of the University of Michigan. The fishes and amphibians are briefly surveyed. The accounts of reptiles and birds are more detailed, as is appropriate because of the more complicated structure and because these types have been so exhaustively studied by Dr. Crosby and her associates. These well-illustrated descriptions lay a secure foundation for the analysis and interpretation of the hypothalamic differentiations shown by the mammals.

The organization and connections of the hypothalamus of man and other primates are presented in Chapter V by Dr. Ingram. The existing confusion in the literature is clarified by a nomenclature consistent with the comparative anatomy of submammalian forms, and an especially valuable feature is the indication of the many places where further anatomical and physiological study is needed before a clear picture of the clinical significance of the hypothalamus can be drawn. A long step in this direction is taken in the papers by Doctors Rasmussen (Chapter VI) and Magoun (Chapter VII), which recount experiments localizing the courses and functions of the efferent fibers.

The most striking cellular elements of the hypothalamus of all vertebrates are the large neurons of the supraoptic and paraventricular nuclei, whose axons have been shown experimentally to supply the very rich innervation of the nervous part of the hypophysis. The peculiarities of these cells have long been known—large size, deep stain, rich vascularization, eccentric and multiple nuclei and astonishing variability of internal structure. In Chapter IV Dr. and Mrs. Scharer summarize an extensive series of histological and experimental studies which, they believe, indicate that these neurons produce an internal secretion in addition to the performance of ordinary nervous functions.

They contain masses of colloid in amounts varying from none to inclusions almost completely filling the cell. The appearance and behavior of these colloid droplets closely resemble those long known in the secretory cells of the thyroid and hypophysis, and these droplets are extruded from the cells in a similar way.

The idea that normal nerve cells may perform the glandular functions of an endocrine organ is so unconventional that a critical attitude, if not skepticism, is to be expected. But the histological evidence marshalled is impressive, and the fact that nerve cells whose axons terminate in an endocrine organ may themselves have an endocrine function is not so anomalous as it seems, when viewed in the light of actual neuroglandular relations in various invertebrates (tunicates, nemerteans, insects, etc.) as revealed by investigations of many competent workers and especially of the Scharrers themselves. They are now attacking the problem from the physiological side, and it is not improbable that these studies may point the way toward the solution of some of the most puzzling problems of endocrinology.

The anatomical part of this work concludes with chapters on the blood vessels of this region by Drs. Finley and Craigie, with findings that seem to favor the hypothesis that the peculiar cells to which reference has just been made are chemoreceptors sensitive to certain chemical constituents of the blood.

In Part II our knowledge of the physiology of

this part of the brain is summarized in chapters on cardiovascular regulation (Bronk, Pitts and Larrabee), body temperature (Ranson), pilomotor regulation (Walker), water metabolism (Hare, Gersh and Barbour), fat metabolism (Gildea and Man), gonadotropic functions (Brooks), sexual behavior (Bard), anterior pituitary function (Uotila), gastro-intestinal regulation (Sheehan), vesical activity (Langworthy), effects of analeptic drugs (Masserman), sleep (Harrison), somatic responses (Hinsey).

These papers present an imposing array of carefully controlled experiments by qualified experts, with technical aids which have been available only within the last few years. The net results are still confused and in some cases contradictory, yet the methods are good and further work along these lines is sure to resolve many obscure and controversial questions. The special value of several of these chapters and of the clinical papers which follow in Part III lies in their negative evidence—the exclusion of some supposed functions of the hypothalamus and the determination of “the exact state of our ignorance” concerning some others.

Diseases involving the hypothalamus include some of the gravest and most puzzling disorders with which medical practice is confronted. The clinical studies of Part III summarize the known facts and still unsolved problems.

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SOCIETIES AND MEETINGS

THE SIXTH WASHINGTON CONFERENCE ON THEORETICAL PHYSICS

March 21–23, 1940

“The Interior of the Earth” was the subject of three days of intensive discussion at the Sixth Annual Conference on Theoretical Physics held in Washington from March 21 to 23, under the joint auspices of the George Washington University and the Carnegie Institution of Washington. A group of fourteen investigators in geophysics and in theoretical physics from various universities in the United States joined a similar number of Washington investigators in a series of informal meetings, in large and small groups, for technical examination of some of the outstanding problems concerning matter in great bulk and under large pressures and temperatures, as found inside the earth. The chief aim of the discussions was to formulate these problems more clearly for future joint efforts.

The first meeting was devoted to the pressure-volume relation at high pressures and associated questions concerning the probable composition and physical state of the earth's deep interior. Professor Fermi introduced the topic. He showed that for pressures higher

than about 10^8 atmospheres the pressure-volume relation can be estimated statistically, and that all materials must behave in a similar way. At these pressures the outer electronic shells of the atoms are crushed; the electrons continue to move in different orbits but can be treated as independent of each other. In this region the pressure increases with the $5/3$ -power of the density. However, the pressure in the interior of the earth only reaches a value of about 3×10^6 atmospheres at the center. Professor Fermi reported the results of a paper by Jensen (*Zeits. Physik*, 1938), who extended these calculations to somewhat lower pressures. Jensen's results are valid only down to about 10^7 atmospheres, but by interpolating between his results and the experimental data at 2 to 5×10^4 atmospheres, one finds agreement with the densities and compressibilities which geophysicists have deduced for the iron in the core of the earth. As one immediate result of these discussions, calculations along similar lines are now in progress for the intermediate pressure region (10^5 to 10^6 atmospheres).

Professor Fermi also estimated the melting-point of iron under a pressure of 3×10^6 atmospheres. He used

a formula based on the assumption that a solid melts if the amplitude of the thermal vibration of its atoms reaches a certain fraction of the interatomic distances. On this basis the melting-point of iron in the core of the earth is approximately $10,000^{\circ}\text{K}$, a value which is rather higher than previous estimates.

Dr. Gutenberg then discussed the evidence from seismology and earth-tides which indicates that the deep interior of the earth is in a fluid rather than a solid state. Dr. Kracek presented various considerations bearing on the composition and probable stratification of the interior, and various points in this connection were discussed by Drs. Gutenberg, Griggs, Herzfeld and Bardeen.

Related material of special interest was presented the following day by Dr. Goranson, who discussed new measurements of compressibility extending to a pressure above 200,000 atmospheres, made with a cascade-bomb equipment under development at the Geophysical Laboratory of the institution for the past year or more.

The main topic of the discussions on the second day was the origin and maintenance of the great magnetic field of the earth. Mr. McNish first gave a description of the magnetic moment, its representation by a minimum number of internal dipoles (fourteen dipoles at the surface of the core, 3,000 kilometers down, plus one eccentric dipole near the center), and discussed the secular variation. Dr. Vestine presented various data and calculations respecting the electrical conductivity of the earth at different depths, as inferred from the diurnal and magnetic-storm variations.

Dr. Elsasser then discussed various theories of the earth's magnetic field. In particular he presented his own recent ideas according to which the magnetic effects may be due to large thermoelectric currents maintained by mass-convection currents in the fluid core. The guiding of this convective flow by the Coriolis forces is used to explain the relation between the direction of the magnetic field and the earth's rotational axis. Questions of energy, viscosity, eddy-currents and differences in temperature and composition in various regions were taken up.

Calculations which throw some doubt on this theory were put forward by Drs. Inglis and Teller. The known heat-transport through the mantle limits the convection-currents and the Coriolis forces, so that the orientation and ordering of the currents remain unexplained. The discussions thus brought out new material on an obscure point; these calculations are now in press.

Dr. Gunn discussed the dynamo-theory in relation to the earth's interior, and the possibility of a ferromagnetic core was discussed by Professor Slater. The Curie point is probably lowered by increase of pressure, but a review of the properties of metals in the

iron group shows that none of these is at all likely to be ferromagnetic at any temperature which is reasonable for the earth's core.

The remainder of the discussions on the second and third days was devoted to radioactivity in the earth and to problems of viscosity. Dr. Urry presented the results of examinations of numerous measurements on the radioactivity of meteorites. If these are fragments of a former planet, the implication is that the interior of the earth has perhaps a hundred times smaller concentration of radioactive material than the crustal rocks. However, even so small an amount of radioactivity distributed throughout the earth produces more heat than is conducted away through the surface. It seems possible on this basis that the core may be several hundred degrees hotter than it was when the mantle first solidified. Dr. Adams summarized recent discussions of rocks which are considered most likely to be similar to the deep-lying parts of the mantle, and which show practically no radioactivity. This may be the real answer to the familiar dilemma of a cooling earth which is overheating from within.

Professor Gutenberg pointed out that according to the analysis of earthquake waves the core of the earth (the region below a depth of 3,000 kilometers) is liquid.

From tidal deformations of the mantle, measured at the earth's surface, one can conclude that the core must have a much lower viscosity than the mantle. Indeed, the low absorption of longitudinal earthquake waves in the core indicates that the core has a viscosity smaller than 10^{10} CGS units, which is roughly the viscosity of ordinary pitch in cold weather. The viscosity throughout the mantle is about 10^{23} CGS units, while molten metals have viscosities smaller than one CGS unit.

Viscous liquids as a rule contain complex chain-like molecules, while all monatomic liquids have low viscosities. It is probable that high pressure does not give rise to a high viscosity for liquid iron. The pressure raises the melting-point, but when melting has taken place the viscosity of the metal should be quite low.

Dr. Griggs and Dr. Gutenberg also discussed general questions concerning the viscosity of solids. It seems that definitions and concepts regarding permanent and non-permanent deformations of solids are as yet not quite clear cut, partly because the behavior of matter in the solid form under continued stress is complicated.

This conference had as its objectives: (a) To formulate the problems and data of geophysics which may be of interest to workers in theoretical physics and (b) to put at the service of workers in geophysics a growing theoretical knowledge concerning the behavior of matter under unusual conditions, especially at very high pressures. Experts in a variety of fields can thus be of mutual assistance if their attention is focussed on certain problems of geophysics. That this meeting pro-

vided an immediate basis for further cooperative work has already been demonstrated, as extended calculations on several questions have already been undertaken by several theoretical physicists, and the Physics Seminar at one university will be devoted next year to geophysics.

Representatives from a total of twenty-four universities, research organizations and governmental bureaus took part in this conference. Among those attending

the conference from outside of Washington were: Professors J. Bardeen, H. A. Bethe, F. Bitter, G. Breit, W. H. Bucher, W. M. Elsasser, E. Fermi, D. T. Griggs, B. Gutenberg, D. R. Inglis, I. I. Rabi, J. C. Slater and J. H. Van Vleck.

EDWARD TELLER

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SPECIAL ARTICLES

COENZYME I AND RIBOFLAVIN CONTENT OF LIVERS OF RATS FED BUTTER YELLOW

KINOSITA¹ and co-workers have shown that liver cancer can be produced in rats by the oral administra-

Nakano and Ohara⁶ also found no difference in the Q_{O_2} 's of the liver slices throughout similar experiments.

Table 1 shows the results obtained from the study of livers of animals which had been on their respective diets between 50 and 110 days.

TABLE 1

	Normal diet	Basal diet	Basal diet and butter yellow	Basal diet and butter yellow and whole yeast	Butter yellow tumor
Q_{O_2}	8.8 (8)	9.0 (14)	9.5 (12)	9.0 (8)	9.5 (8)
Ribo-flavin	170 (8)	124 (12)	70 (17)	170 (8)	33 (8)
Co I	1390 (8)	1370 (12)	500 (21)	1400 (8)	150 (8)
					gammas per gm dry wt.
					gammas per gm wet wt.

NOTE: Numbers in parentheses refer to number of animals.

tion of dimethylaminoazobenzene (butter yellow). The chemical is fed (20 cc of 3 per cent. solution in olive oil to 1,000 grams of diet) in a diet of brown rice supplemented with carrot. Nakahara, Fujiwara and Mori² reported that beef liver added to the diet will prevent cancer production and Ando³ published evidence that yeast also is protective.

We have investigated the *in vitro* respiratory rate as well as the Coenzyme I and riboflavin contents of the livers of rats fed various diets, as follows: (1) normal diet, (2) basal diet without butter yellow, (3) basal diet with butter yellow and (4) the same with 15 per cent. of dried brewers' yeast (No. 2040 Fleischmann Laboratories) added.

The Q_{O_2} 's were measured in a Warburg respirometer. The Coenzyme I content was measured by means of the fermentation technique of Myrback,⁴ which was standardized in our laboratory by Dr. S. O. Dexter. The riboflavin was measured by a modification of the method of Hodson and Norris.⁵

We have found that the riboflavin and the Coenzyme I contents of the livers decrease markedly, whereas the Q_{O_2} 's of the liver slices do not change. Nakatani,

The Coenzyme I content of the kidneys of the same animals was not decreased in any group, a fact which serves as a check of the precision of the method:

CoI 1410 (8) 1400 (12) 1490 (16) 1380 (8) gammas per gram wet weight

The measurement of either flavin or Coenzyme I content of the liver serves as a useful index of the protective effect of dietary supplement.

Experiments are now in progress to determine whether or not the administration of nicotinic acid and riboflavin in large amounts will protect against the action of dimethylaminoazobenzene in the rat. Nakahara and coworkers have reported that the administration of 3 mg per rat per day of nicotinic acid and 20 gammas of riboflavin does not protect.^{2b}

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BOVINE PSEUDORABIES OR "MAD ITCH" VIRUS

SINCE Shope¹ described "mad itch" in cattle in Iowa and subsequently² set forth the immunological relation of this disease to pseudorabies as described by Anjeszky³ in Hungary, an occasional effort has been

⁶ Nakatani, Nakano and Ohara, *Gann*, 32: 240, 1938.

¹ R. E. Shope, *Jour. Exp. Med.*, 54: 233, 1931.

² *Ibid.*, *Proc. Soc. Exp. Biol. and Med.*, 30: 308, 1932.

¹ Kinoshita, *Trans. Jap. Path. Soc.*, 27: 665, 1937.

² Nakahara, Fujiwara and Mori, (a) *Gann*, 33: 57, 1939; (b) *Gann*, 33: 406, 1939.

³ Ando, *Gann*, 32: 252, 1938.

⁴ K. Myrback, *Ergeb. Enzymforschung*, 2: 139, 1933.

⁵ Hodson and Norris, *Jour. Biol. Chem.*, 131: 621, 1939.

made to determine the relation, if any, of "mad itch" virus, to a rarely occurring but fatal bovine pruritic syndrome in Illinois. Pursuant to this inquiry, tissues from suspected natural cases have been examined for the presence of a filtrable virus. Notwithstanding the clinical resemblance of the disease reported by Illinois veterinarians to the "mad itch" syndrome in cattle, the virus of the disease was only recently identified in Illinois.

In February, 1940, a well-nourished Hereford steer (24333) weighing approximately 1,000 pounds, displaying a syndrome resembling that of pseudorabies, was brought to the university laboratory for examination. Twenty-four hours later, the animal, in a moribund condition, was sacrificed for autopsy. No gross pathologic lesions were noted other than self-inflicted lacerations of the skin and subcutaneous tissue in the left dorso-lumbar region.

Anaerobic and aerobic cultures of the heart blood, brain and dorsal spinal cord proved negative. Physiological sodium chloride suspensions of the brain and spinal cord as well as urine collected aseptically from the bladder were injected subcutaneously into a series of 12 rabbits and 12 guinea pigs. All inoculated rabbits and guinea pigs, with the exception of those receiving the dorsal spinal cord tissue, remained healthy. Both rabbits and one of the two guinea pigs receiving subcutaneous injections of the spinal cord tissue succumbed in 80 to 108 hours. Preceding death, the inoculated rabbits and guinea pig showed markedly increased respirations and evidence of intense pruritus near the point of inoculation. A filtrable agent (Berkefeld N) which reproduced the disease in rabbits and a calf, was demonstrated in the combined spinal cord tissue of the steer and the spinal cord tissue of rabbits that succumbed following inoculation. In further confirmation of the nature of the filtrable agent the chorio-allantoic membrane of twelve-day chick embryos inoculated (Goodpasture method⁴) with the bacteriologically sterile spinal cord tissue suspension resulted in abundant gross lesions similar to those reported by Glover.⁵ Serum neutralization tests of the steer spinal cord virus (24333) were conducted by Shope.⁶ The results of his immunological tests support the preliminary deduction that the virus is that of pseudorabies or "mad itch."

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³ A. Aujeszky, *Centr. Bakt. I. Abt.*, 32: 353, Orig., 1902.

⁴ E. W. Goodpasture, A. M. Woodruff and J. G. Buddingh, *SCIENCE*, 74: 371, 1931; *Amer. Jour. Path.*, 8: 271, 1932.

⁵ R. E. Glover, *British Jour. of Exp. Path.*, 20: 150, 1939.

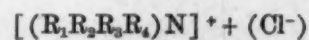
⁶ R. E. Shope, personal communication.

INHIBITION OF BACTERIAL METABOLISM BY SYNTHETIC DETERGENTS¹

THE bactericidal and lytic action of soaps and certain naturally-occurring detergents such as bile salts has been recognized for some years. Recently, the demands of industry for wetting agents and detergents to meet a variety of special purposes have led to a very rapid commercial development of these compounds. More than a thousand wetting agents and detergents have been patented in the past decade. In 1935 Domagh² reported that the quaternary ammonium detergent, Zephiran [alkyl (C_8 to C_{18}) dimethyl benzyl ammonium chloride], possesses germicidal properties, and he recommended its use for disinfection of skin surfaces. Katz and Lipsitz³ found that one cationic and three anionic synthetic wetting agents inhibited the growth of *Mycobacterium smegmatis*. Cowles⁴ and Birkeland and Steinhaus⁵ made the interesting observation that alkyl sulfates selectively inhibit the growth of gram-positive organisms.

A very marked inhibitory action of Zephiran on the respiration and glycolysis of pure cultures of microorganisms associated with dental caries has been demonstrated by Miller, Baker and Harrison.⁶ Also, as shown by Miller, Muntz and Bradel,⁷ this compound penetrates the dense matrix of human dental plaque material both *in vitro* and *in vivo*, and inhibits the metabolism of the mixed flora.

In the present communication we report some results obtained in a study of the effects of a variety of synthetic wetting agents and detergents on bacterial metabolism. The metabolism of freshly prepared suspensions of microorganisms was measured in the usual manner in the Warburg manometric apparatus in the presence of either phosphate or bicarbonate buffer at pH 7.3. The vessels contained 15 to 25 billion cells in a volume of 3 cc. Six gram-positive and six gram-negative organisms were studied. The detergents and wetting agents have been classified as *cationic* or *anionic*. Thus Zephiran, typical of the cationic compounds, ionizes with the long-chain hydrophobic group in the cation:



Sodium cetyl sulfate, typically anionic, ionizes with the hydrophobic group in the anion as follows: $(C_{16}H_{33}-O-SO_3)^- + (Na)^+$.

Several types of *cationic* detergents have been investigated. These may be grouped as follows: (a) *quater-*

¹ From the Walter G. Zoller Memorial Dental Clinic and the Department of Medicine, University of Chicago.

² G. Domagh, *Deutsche Med. Wochenschr.*, 61: 829, 1935.

³ J. Katz and A. Lipsitz, *Jour. Bact.*, 30: 419, 1935; 33: 479, 1937.

⁴ P. B. Cowles, *Yale Jour. Biol. Med.*, 11: 33, 1938.

⁵ J. M. Birkeland and E. A. Steinhaus, *Proc. Soc. Exper. Biol. and Med.*, 40: 86, 1939.

⁶ B. F. Miller, Z. Baker and R. W. Harrison, *Proc. Soc. Exper. Biol. and Med.*, 42: 705, 1939.

⁷ B. F. Miller, J. Muntz and S. Bradel, in press.

nary ammonium compounds containing aromatic or alkyl-phenyl radicals: Zephiran [alkyl (C_8 to C_{18}) dimethyl benzyl ammonium chloride]; Triton K-12 (chiefly lauryl dimethyl benzyl ammonium chloride); Triton K-60 (chiefly cetyl dimethyl benzyl ammonium chloride); Hydrocide (alkyl hydroxy benzyl dimethyl ammonium phosphate); (b) *quaternary ammonium compounds containing only aliphatic groups*: Dupont Retarder LA (stearyl trimethyl ammonium bromide); Damol [$(CH_3)_2(C_{12}H_{25})N(Br)-CH_2-CHOH-CH_2-(Br)N(C_{12}H_{25})(CH_3)_2$]; Emulsol-605 [$C_{11}H_{23}-COO-C_2H_4-NH-CO-CH_2-N(CH_3)_3Cl$];⁸ (c) *quaternary ammonium salts containing heterocyclic nitrogen*: CēPryn chloride⁹ (cetyl pyridinium chloride); Emulsol-660 B (lauryl pyridinium iodide); (d) *non-quaternary compounds*: only one such detergent was available for our studies, Emulsol-606, which is the lauryl ester of glycine hydrochloride.⁸ It was found that all of these compounds inhibited the metabolism of the organisms almost completely at a concentration of 1:3000. Most of the compounds were equally effective at 1:30,000. In a few cases a marked effect on bacterial metabolism was noted at concentrations as low as 1:60,000. *These cationic detergents inhibited the metabolism of both gram-positive and gram-negative microorganisms to the same degree.*

The effects of the following *anionic* detergents were studied: sodium cetyl sulfate; Duponol LS (sodium oleyl sulfate); Igepon A ($R-COO-CH_2-CH_2SO_3Na$) and Igepon T [$R-CO-N(CH_3)-(CH_2)_2SO_3Na$]; Tergitol 7 (sodium alkyl sulfate, alkyl=3,9 diethyltridecanol-6); Drene (triethanolamine lauryl sulfate); Triton W-30 (sodium salt of alkyl phenoxy ethyl sulfonate); Triton 720 (sodium salt of alkyl phenoxy dialkoxy sulfate); Nopecastor V (sulfonated castor oil); sodium taurocholate. In contrast to the results

with the cationic compounds, it was found that few of the anionic wetting agents inhibited the metabolism of either gram-positive or negative organisms appreciably at a concentration of 1:30,000. Only one, Tergitol 7, was able to inhibit completely the six gram-positive organisms at a dilution of 1:3000. At this concentration, the other anionic compounds inhibited some, but not all of the *gram-positive* bacteria. There was seldom any significant effect by these compounds on the metabolism of *gram-negative* organisms at the 1:3000 dilution.

It may be concluded that the *cationic* type of detergent is a more general inhibitor of bacterial metabolism than the *anionic*.

Variations in the pH of the buffer medium caused striking differences in inhibitory action. It was found that the effect of the cationic compounds increased progressively as the pH was shifted toward the alkaline side, whereas inhibition by the anionic types increased with a shift toward the acid side.

A series of pure alkyl sulfates ranging from C_8 to C_{18} was studied on some gram-positive organisms. It was found that the C_{12} and C_{14} (lauryl and myristyl) compounds gave the maximum inhibitory effects.

We have found that Damol, Emulsol-605 and Emulsol-606 possess a reasonably low toxicity for mice by intraperitoneal injection, and that they produce little or no irritation in the rabbit eye at concentrations of 1:500 to 1:1000. Of these, the lauryl ester of glycine hydrochloride (Emulsol-606) is the least toxic. The protective action of these compounds towards experimentally-induced infections is being studied.

The experiments described here will be published in full elsewhere.

BENJAMIN F. MILLER

ZELMA BAKER

THE UNIVERSITY OF CHICAGO

SCIENTIFIC APPARATUS AND LABORATORY METHODS

ETHYL METHACRYLATE AS A MOUNTING MEDIUM FOR EMBRYOLOGICAL SPECIMENS

A *SUITABLE* method of mounting various embryological specimens such as small mammalian embryos, older chick embryos and amphibian eggs and embryos has always been a problem for the teacher of embryology. These objects were too large for balsam mounts; if they could be mounted in balsam, they dried very

slowly and were very easily broken. The only satisfactory method has been to study these objects in dishes of a preservative such as alcohol. Experiments carried out recently in this laboratory have shown that permanent preparations of splendid optical qualities can be made by embedding these objects in one of the clear plastics, ethyl methacrylate. The manner in which this is accomplished is described below.

The unpolymerized ethyl methacrylate monomer can be obtained from the Rohm and Haas Chemical Co., Philadelphia, Pa., at a cost of about \$6.00 per gallon. This material is shipped with an inhibitor, hydroquinone, which must be removed before polymerization. This inhibitor is removed by washing a sample of the monomer (300 cc samples are used in this laboratory) four or five times with a 5 per cent. KOH solution.

⁸ We are indebted to Messrs. A. K. Epstein and B. R. Harris, chemists of the Emulsol Corporation, for suggesting that bactericidal compounds of the type 605 and 606 would possess low local and systemic toxicity.

⁹ The toxicity and germicidal action of cetyl pyridinium chloride have been investigated by R. S. Shelton *et al.* (Abstracts 99th Meeting of the American Chemical Society, April, 1940).

Excess KOH is removed by several washings with tap water. The sample is dehydrated by allowing it to stand over anhydrous sodium sulphate for twelve hours. When filtered the material is ready for polymerization.

Polymerization is effected by a catalyst, benzoyl peroxide. A stock solution of the catalyst is made by dissolving 5 grams of benzoyl peroxide in 100 cc of the inhibitor-free monomer. This solution should be kept in a refrigerator. When the sample is ready for polymerization, this solution is added in the ratio of 1 part to 10 parts of the inhibitor-free monomer. The sample, now measuring 330 cc is placed in a well corked 500 cc Erlenmeyer flask. The flask is placed in a water bath at a constant temperature of 85° C. The flask should be continually agitated while in the water bath. Every two or three minutes the flask should be removed from the water bath, the cork removed to admit air, replaced and the flask well shaken. This treatment allows for a dissipation of the heat generated in the polymerization reaction. If this procedure is not carefully followed, the reaction will get out of control, a rapid boiling and hardening of the material will result in a loss of the entire sample. After 20 to 30 minutes of heating and shaking, the sample will be partially polymerized and will have a viscosity about like that of molasses. At this point, the flask should be well corked and the partially polymerized material placed in the refrigerator until needed.

Small, thin-walled glass preparation dishes holding about 25 cc make very good molds for these preparations. A dish of this type is filled to a depth of about $\frac{1}{4}$ inch with the partially polymerized material prepared above. The dish is well covered and placed in an oven at 50° C. for a period of 24 hours. This final heating results in a complete polymerization of the material and forms a solid base on which the object may be mounted.

The embryo to be mounted, for example, a 4-day chick embryo, is prepared in the same manner as for balsam mounting. The embryo is stained with borax-carmines or alum-cochineal, dehydrated with a series of alcohols and cleared in xylene. From the xylene it is placed in a small open dish of the partially polymerized material for a period of 30 minutes to allow for an evaporation of the xylene. From this medium it is transferred to the dish containing the polymerized base and well covered with the partially polymerized monomer. The dish is covered, returned to the oven at 50° C. and kept there until the preparation is thoroughly hardened. When completely hardened, the specimen is chilled with ice water or solid carbon dioxide, which loosens the cast from the glass mold. No satisfactory way of getting the cast from the mold has been found and, in most cases, the glass mold must be broken.

Preparations made in this way have many distinct advantages. When studied under the dissecting microscope or the lower magnifications of the compound microscope, the optical qualities of such a preparation are as good, or better, than those of balsam-glass preparations. The embryo may readily be studied from either side and the mount is unbreakable. This plastic material is more susceptible to scratching than is glass, but with reasonable care, this is not a serious objection to the method.

If it is desirable to make these mounts in the nature of microscope slides, this may easily be done. Polished sheet Plexiglas (methyl methacrylate) 0.08 inch in thickness and cut to standard microscope slide size, 3 × 1 inches, can be purchased from the Rohm and Haas Chemical Co., Philadelphia, Pa. Rings for making the cells in which the embryos will be mounted on the slide can be made in the following way. Polished Plexiglas rod, $\frac{3}{4}$ inch in diameter can be obtained from the company mentioned above. Using a lathe, this rod is converted into a tube with a bore of approximately $\frac{5}{8}$ inch. Using the cutting tool of the lathe, this tube is now cut into rings of various thicknesses, $\frac{1}{4}$, $\frac{3}{16}$ and $\frac{1}{8}$ inches, dependent on the size of the object to be mounted. These rings are fastened to the Plexiglas slide with a cement, Acryloid B-7, which is a 20 per cent. solution of polymerized methyl methacrylate in ethylene dichloride. The object to be mounted is prepared in the same way as for mounting in a disc. It is transferred to the cell just described, well covered with the thick, partially polymerized ethyl methacrylate and placed in the oven at 50° C. to complete polymerization. There is some loss in volume during the polymerization process and fresh monomer must be added as the hardening process takes place.

W. O. PUCKETT

PRINCETON UNIVERSITY

BOOKS RECEIVED

- BEAUCHAMP, WILBUR L., JOHN C. MAYFIELD and JOE YOUNG WEST. *Everyday Problems in Science*. Pp. xvi + 752. 532 figures. Scott, Foresman. \$1.72.
- CABLE, EMMETT J., ROBERT W. GETCHELL and WILLIAM H. KADESCH. *The Physical Sciences*. Pp. xvii + 754. 300 figures. Prentice-Hall. \$5.00. To schools, \$3.75.
- LANE, ERNEST P. *Metric Differential Geometry of Curves and Surfaces*. Pp. viii + 216. University of Chicago Press. \$3.00.
- LINTON, EDWIN. *Trematodes from Fishes Mainly from the Woods Hole Region, Massachusetts*. Pp. 172. 26 plates. U. S. National Museum.
- MIDDLEMISS, ROSS R. *Differential and Integral Calculus*. Pp. x + 416. 171 figures. McGraw-Hill. \$2.50.
- ORR, ROBERT T. *The Rabbits of California*. Pp. 207. 30 figures. 10 plates. California Academy of Sciences. \$3.50.
- SCHUCHERT, CHARLES and CLARA M. LEVENE. *O. C. Marsh, Pioneer in Paleontology*. Pp. xxi + 541. Yale University Press. \$5.00.
- ZIMMERMANN, ARNOLD A. *Origin and Development of the Lymphatic System in the Opossum*. Pp. 197. 92 figures. University of Illinois Press. \$3.00.

Three Outstanding New Books

HEREDITY AND SOCIAL PROBLEMS

By L. L. BURLINGAME, Stanford University. *McGraw-Hill Publications in the Zoological Sciences.* In press—ready in January

In a concise, simple treatment this important new textbook introduces the student to the biology of reproduction and its consequence, heredity, and shows him how and when this knowledge can or cannot be applied to social problems. The author sets forth as clearly as possible the way in which heredity and environment jointly control the development of organisms, including man. The influence of changes in birth and death rates, immigration, war, and the differential fertility, on the genetic composition of populations, is described. There is a discussion of practicable methods which might be used to alter the rate or direction of any of these changes that society may think necessary or desirable. One of the most interesting sections of the book indicates the bearing of genetics on education and on the theories and practices of government.

AMERICAN MAMMALS. Their Lives, Habits, and Economic Relations

By W. J. HAMILTON, JR., Cornell University. 434 pages, 6 x 9. \$3.75

This is a new approach to the study of mammals. The author discusses the subject from the ecological viewpoint, illustrating how mammals are adapted to their environment, instead of giving the customary specific accounts of each species. Thus the book treats in detail the various phenomena common to mammals in order to acquaint the student with their characters, distribution, habits, and economic relations. The book is fully illustrated, and includes many original photographs and drawings.

QUANTITATIVE ZOOLOGY. Numerical Concepts and Methods in the Study of Recent and Fossil Animals

By GEORGE G. SIMPSON, The American Museum of Natural History, and ANNE ROE.
McGraw-Hill Publications in the Zoological Sciences. 414 pages, 6 x 9. \$4.00

Original in presentation and treatment, this book provides the student with sound basic principles of the quantitative phases of zoology and paleontology and with detailed means of dealing with these data in the most valid and enlightening way. After examining the nature and properties of numerical data in zoology, the book takes up their proper and efficient use in the study of taxonomy, morphology, physiology, ecology, and other phases of zoology, both descriptive and interpretive. The section on single specimens is completely new.

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SCIENCE NEWS

Science Service, Washington, D. C.

THE EARTHQUAKE IN ASIA MINOR

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JUST as man-made bridges are less sturdy than the solid land they connect, so too are the great "land bridges" of the earth which link continents more unstable than other regions. The land bridge areas of the earth are characteristically earthquake areas and so it is with the Asia Minor region which produced the terrific post-Christmas shock that has killed thousands in Turkey.

World-wide seismological earthquake records gathered by Science Service and sent to the U. S. Coast and Geodetic Survey for analysis show that the shock's epicenter was at latitude 39 degrees north and longitude 39 degrees east; approximately 100 miles southwest of the Turkish Black Sea port of Trebizond. The epicenter thus came almost directly under the large town of Erzinjan in the Armenian mountain terrain. The first shock on December 26 is known to have occurred exactly at six hours, 57.4 minutes P.M. Eastern Standard Time.

Rugged mountain ranges mark the region and the average altitude of the country is about 7,000 feet. The severe temperature of 22 degrees below zero, reported in scattered cables by the press, is thus understandable at this time of year. The sharply-folded mountainous terrain of Asia Minor continues over to become the Balkan Mountains, the Dinaric Alps and the Alps in Europe. At the Spanish-French border they form the towering Pyrenees and the elevated Spanish Plateau. One fringe of the mountains shoots off southward and becomes Italy and the hills of Sicily. Although now separated by the waters of the Mediterranean Sea, it is probable that Italy and Sicily once formed an additional land bridge linking Europe and Africa. Characteristic of present and former land bridge areas of the earth are their often mountainous terrain, potential volcanic activity and earthquake susceptibility. The link between North and South America is typical as is the region linking Asia and North America around Alaska. Not all the world's earthquake regions, however, are necessarily of the land bridge type. The countries and regions which border on the Pacific Ocean—Japan, the west coast of the United States and Canada and the nations on the western side of South America—are of this character.

Considering the number of earthquake shocks which occur over the earth in a year, one finds that a disaster like that in Turkey is the exception. The Turkish shock was a strong one, but its damage came because it occurred in a region having a fairly large population. Many a severe quake is recorded which is little noted because it occurred in remote areas with little loss of life.—ROBERT D. POTTER.

GERM-KILLING CRYSTALS FROM SOIL BACILLI

(Copyright, 1939, by Science Service)

PNEUMONIA protection by crystals of a chemical obtained from germs that prey on other germs was an-

nounced by Drs. René J. Dubos and Rollin D. Hotchkiss, of the Hospital of the Rockefeller Institute for Medical Research, New York, at the meeting in New Haven of the Society of American Bacteriologists.

So far, only mice have been given the new germ-killing crystals. Studies on other animals and other disease-causing germs besides the pneumococcus are under way, but have not yet been completed. The material described is so powerful that one millionth of an ounce is sufficient to protect a mouse from a pneumonia infection which would otherwise kill it rapidly.

Another chemical compound was obtained in pure crystalline form from the same germ source, but this second compound is ineffective in mice. Studies of the chemical differences between the two compounds will, it is hoped, help to explain what is necessary to secure a protective action against infection within the body of the animal.

Discovery of the germ-killing and apparently curative material was the result of a deliberate search in which the investigators took advantage of the fact that certain species of microorganisms or germs are known to be antagonistic to other species of microorganisms.

Staphylococci, commonly found in boils, abscesses and flesh wounds, were the bacteria chosen as the prey. Bacilli able to live upon them were found in soil. When grown in artificial media free from other bacteria, the bacilli still retain the ability to kill staphylococci and grow and multiply in their presence. Furthermore, the bacilli were found able to kill not only the one species, but also a large group of organisms having in common with staphylococci the property of being "Gram-positive" (meaning that they are dyed in a particular way by a much-used bacteriological stain). Some other Gram-positive bacteria which are also susceptible are streptococci, pneumococci and diphtheria bacilli.

From the bactericidal organisms was obtained a non-living chemical agent which by itself was able to kill the Gram-positive microbes. This chemical agent has now been further purified, and two pure crystalline chemical compounds have been isolated from it. Both of these bactericidal compounds are so active that a millionth of an ounce is sufficient to kill a few billion pneumococci in the test-tube.

CHEMICAL CURES OF DISEASE

(Copyright, 1939, by Science Service)

MORE successful use of sulfanilamide and related chemicals in curing germ diseases is promised by a new test reported on December 28 by Professor E. K. Marshall, Jr., of the Johns Hopkins University, to the Society of American Bacteriologists at New Haven. The test, which takes advantage of the feeding habits of mice, provides a much-needed method of evaluating chemical remedies on a quantitative basis. It was worked out by Professor Marshall and associates.

Sulfanilamide, sulfapyridine or some other chemical remedy is mixed with the food of the mice. Because

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By **V. K. ZWORYKIN** and **G. A. MORTON**, *both with RCA Manufacturing Company.*

A detailed survey of this newest of practical means of communication. The book is written from an engineering standpoint. Emphasis is placed on application of the fundamental principles. The authors are two of the foremost men in the field.

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Edited by **GEORGE R. HARRISON**, *Professor of Physics, Massachusetts Institute of Technology.*

The twenty-nine papers of the 1939 Conference, presenting latest developments in the applications of the rapidly-growing science of spectroscopy. The subjects covered include general background and methods, specific types of analysis, recently developed apparatus, absorption spectrophotometry, etc.

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Approx. 146 pages; 69 illus.; 7½ by 10; Probable price, \$2.75

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these animals eat frequently and at regular intervals, there is always some of the chemical in their systems. A constant concentration of the remedy can thus be maintained in the animal's blood, and this gives a basis for determining what blood concentration is necessary to cure streptococcus infection, or which of several remedies is more effective in amounts that give the same concentration in the blood.

From such studies, Professor Marshall explained, it can be learned more exactly which remedy to use, how large a dose is effective, and how often it needs to be repeated. At present, he pointed out, the value of sulfanilamide and related remedies is somewhat hampered by lack of exact information on these points.

The way in which sulfanilamide acts in the body to check the growth of disease germs and thus "cure" the patient might also be determined from such quantitative comparisons with other similar chemicals. This knowledge might lead to the development of even more effective chemical remedies.

ELECTROSTATIC ELECTRICITY IN INDUSTRIAL SEPARATION OF PARTICLES

(Copyright, 1939, by Science Service)

ELECTROSTATIC electricity is now being used by the food industry for the dry separation of particles.

Shelled nut meats can be separated from the shells. Raisins can be stripped from leaves and stem material. Watercress seed can be removed from rice, and pest seeds separated from various economic seeds, according to the report of O. C. Ralston and Foster Fraas, of the U. S. Bureau of Mines, given on the Chemical Engineering Symposium of the American Chemical Society at the University of Michigan on December 29.

Electrostatic separation—making use of the different behavior of dissimilar particles under the influence of an electric field—has long been used for mineral separation. To a large degree it has been superseded in this field, however, by flotation methods. In contrast, the food industries, where a dry separation is needed, use it widely and it is constantly being improved. This progress, in turn, indicates possibilities of applications in mineral separation by the electrostatic method. One new advance is to pre-condition the surface of the mineral to be separated so that the particles can be more easily drawn apart in the electric fields. Acidic gases, such as hydrofluoric acid, have been found effective for silicate minerals. Feldspar and quartz can be separated by this method. The hydrofluoric acid forms potassium and aluminum fluorides on the feldspar particles, whereas the quartz particles are merely etched by the treatment and silicon tetrafluoride vapor passes off.

For the separation of minerals like limestone, dolomite, magnesite and borax, vapors of acetic and benzoic acids have been used for the pre-conditioning treatment.

THE ALARMING TREND OF POPULATION

ALARM over the trend toward lower birth rates was expressed by Professor Raymond Pearl, of the Johns Hopkins University, in his presidential address before the American Statistical Association, in which he said people

in the prime of life are contriving to throw off some of the burden of supporting young and old by having fewer children.

"Just possibly what mankind is slowly and steadily doing," Professor Pearl said, "may turn out in the long run to be the moral equivalent of curing a toothache by the effective but disastrous technique of cutting off the patient's head. There is no good in making life easier if there is not going to be anybody around to live it."

The world's population, he said, increased nearly five-fold in the three centuries between roughly 1630 and 1930. This brought about present efforts to lessen crowding and discomfort, which now are showing results in lowered birth rate and increasing numbers of the old.

Analyzing the population problems of the United States, and citing "such weird economic philosophies as those currently associated with 'ham and eggs' or '\$200 a month,'" Professor Pearl said: "It is plain that the old folks, on the one hand, and the youngsters, on the other hand, by their own lusty bellowings and the supplementary skulduggery of their 'humanitarian' friends are ganging up, as the expressive phrase goes, on the half of the population that does the work, pays the bills and taxes, and in cold fact earns the livings for all."

Counting both young and old, the burden borne by the harassed section of the population between fifteen and fifty years old is actually not so great as it was a century ago, Professor Pearl finds. In 1840 for every 1,000 persons of these ages there were 1,084 younger or older to be taken care of; in 1930, for each 1,000 of the "reproducer-worker phase of life" there were only 880 persons besides themselves to be cared for.

To instill into the minds and consciences of the mass of our people that their chief concern is the composition of the population may, Professor Pearl said, be the principal duty of the American Statistical Association in years ahead.

THE SLAUGHTER OF BISONS BY THE CANADIAN GOVERNMENT

BISON are being killed by the thousand at Buffalo National Park near Wainwright, Alta., in the greatest slaughter of these animals since the days of Buffalo Bill. The range must be cleared of all animals before spring, by order of the Canadian Government. It is needed for other purposes, though official silence is preserved on what these purposes are. Rumor says the area is to be used as a great aviation training area, for the education of thousands of flying fighters for duty overseas.

Before the hunters began the slaughter, there were more than 3,000 bison on the range, besides 1,500 elk, 500 deer, 125 moose and 35 imported yak from Tibet. The elk are being given to Indians on reservations as they are killed, the bison carcasses will be butchered and the meat and hides sold on the market.

Wiping out of the Wainwright herd will not, of course, mean the end of bison in Canada. The largest herd of these animals in the world, some 30,000 head, are kept on a tremendous range of 17,000 square miles of wooded country, in northern Alberta and southern Mackenzie provinces. A considerable surplus of animals from the

Wainwright herd were sent to the great range some time ago, and smaller surpluses have also been distributed to other ranges and parks in Canada. Canadian conservation officials state that the range at Wainwright has deteriorated through over-grazing, so that it would be inadvisable to keep so many animals there regardless of other possible uses for the land.

The Wainwright herd had its beginnings a generation ago, when the Canadian government bought 700 head from Michael Pablo, a Mexican ranch owner living in Montana. Mr. Pablo had built up his herd from a few survivors of the great slaughter on the Great Plains during the latter part of the nineteenth century. When the bison began to become too numerous for him, he offered his herd for sale to the United States government, but was turned down. The Canadian government then bought the 700 animals, at \$250 each, and moved them to the Wainwright area, where the herd grew by natural increase to more than 3,000 head.

Before the depression, surplus animals were shipped to the great northern bison range. When shipping costs became too much for the Canadian budget, the surplus was killed and marketed. The present wholesale slaughter is being handled by a modern packing firm which secured the contract on bid.

THE EVOLUTION OF MAN

(Copyright, 1939, by Science Service)

THERE was no one cradle of humanity from which all the kinds of man grew up. Man evolved in various parts of the world, faster in some regions than in others, according to Dr. Franz Weidenreich of Peiping Union Medical College, in a paper read before the American Anthropological Association.

Dr. Weidenreich, who is best known for his studies of ancient remains of Peking Man discovered in caves near Peiping, pointed out that "in the past decade our knowledge of fossil man has advanced as in no earlier period." From skeletal remains of ancient man now available for scientific scrutiny it is now clear, he said, that there were varied types of man on earth during each successive phase of evolution as far back as prehuman, or pre-man, days. In each phase, he explained, all individuals had certain features in common, just as *Homo sapiens*, who rules the world to-day, belongs to one species the world over. But just as *Homo sapiens* is divided into races, so his predecessors appeared somewhat different in different regions.

In their own parts of the world, such hoary prehumanoids as Pithecanthropus of Java and Peking Man of China, who lived half a million years or more ago, were ancestors to later types in their own regions, said Dr. Weidenreich. Western Europe's undiscovered prehumanoids may prove to be much older than those of Asia, he pointed out, because more advanced types of man were so ancient in regions such as England. Pre-man types found in Java and China indicate to Dr. Weidenreich that man must have branched off very early "from a common anthropoid-like stem which had already adopted an upright posture, while braincase, jaws and dentition still retained their anthropoid characteristics."

ITEMS

A NOVA, or "new" star, similar to what the Star of Bethlehem may have been, was discovered on Christmas Eve by Dr. F. L. Whipple, of the Harvard College Observatory. It is now of tenth photographic magnitude, and thus invisible to the naked eye. Evidence indicates that it flashed to its maximum brightness some time last summer, but then eluded the watchfulness of astronomers. It is located in the minor constellation Monoceros, the Unicorn, near the southern horizon.

THREE more "white dwarf" stars, heavyweights of the heavens, have been found by Professor Gerard P. Kuiper, of the McDonald Observatory at Fort Davis, Texas, raising the number known to twenty-five. White dwarf stars are relatively close to earth and some of them weigh a million pounds per cubic inch. The new white dwarfs are Wolf 1, Ross 548 and the faint star in what astronomers call Selected Area 26. They are all comparatively lightweights, with densities of about 3 tons per cubic inch, which still is thousands of times the weight of earthly matter.

THE year 1939 will go into the pages of weather history as the "warm" year, according to a summary just prepared by J. B. Kincer, chief of the Division of Climate and Crop Weather of the U. S. Weather Bureau. Only one month, February, can be classed as abnormally cold for the nation as a whole. All the other months were either moderately warm or were definitely far above ordinary seasonal temperature. December, in particular, has been way above temperature averages for this time of year.

Two of the most important colors in nature—the red pigment of blood, known as hemin, and the green pigment of leaves, known as chlorophyll—have molecules shaped like little wagon wheels, round and flat, Dr. R. P. Linstead, of Harvard University, stated at the Eighth National Organic Chemistry Symposium of the American Chemical Society meeting at St. Louis on December 29. The "hubs" of the molecule "wheels," he explained, are different for hemin and chlorophyll. In the center of the hemin wheel is an iron atom. In the center of a chlorophyll wheel is a magnesium atom.

A PREHISTORIC crossroads, where at least three early Indian tribes left traces of their presence, has been discovered by archeologists in the area of north-central Texas soon to be flooded by Possum Kingdom Dam. Shortage of WPA workers has temporarily halted joint efforts of the University of Texas and the WPA to salvage all possible Indian material in the sector before the dam is completed late in 1940. Bison which thronged Possum Kingdom Basin are believed the attraction which drew aborigines from various parts of Texas. The excavations thus far have shown a new southern limit to which certain cultural traits of Plains Indians spread. Hope that the shutdown will be brief is expressed by A. T. Jackson, of the University of Texas, in charge of excavations, because time lost now means "work can never be done."

Determination of Bismuth

REAGENT—Quinaldine

METHOD—Volumetric

REFERENCE—Hayes and Chandlee, *Ind. Eng. Chem., Anal. Ed.*, **11**, 531 (1939)

BISMUTH, in the presence of dilute sulfuric acid and an excess of potassium iodide, is completely precipitated by quinaldine. The percentage of bismuth in the sample may then be readily determined volumetrically. The average error is less than .3 percent under most conditions, and interference in the reaction is encountered only with mercury and silver.

Eastman Quinaldine, No. 216, is furnished in the purity that is essential for such analytical purposes. An abstract outlining the use of this reagent in the above procedure will be forwarded promptly upon request. . . . Eastman Kodak Company, *Chemical Sales Division*, Rochester, N. Y.

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SCIENCE NEWS

Science Service, Washington, D. C.

GEOLOGICAL PAPERS AT MINNEAPOLIS

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FLOWAGE marks on laboratory samples of steel closely resembling certain markings in folded rock structures were described at the meeting of the Geological Society of America by Dr. A. Nadai, of the Westinghouse Company. Slip surfaces, formed in laboratory samples of steel when it is put under enough pressure, closely resemble the great faults or breaks in bedrock, that are geological features of some parts of the country. Dr. Nadai's researches show that laboratory samples of even the strongest alloy steels creep indefinitely under pressure if sufficiently hot. From these experiments, geologists may be able to determine what happens to rocks at great depths when deformation occurs.

RECRYSTALLIZATION of rock components, and the "lining up" of the newly formed crystals as the rocks are folded may be important factors in the production of zones of weakness in these rocks, according to Dr. C. O. Swanson, of the University of British Columbia.

REPEATED deformation of the Sierra Nevada region, studied by Dr. Evans B. Mayo, of Goldfield, Nev., whose researches were supported by the U. S. Geological Survey, resulted in a series of structures of various ages. Where ancient structures intersected, great intrusions of molten rocks occurred. Later, during the ice ages, great volcanoes burst forth at the intersections of the younger structures.

RIGIDITY acquired by rocks when they recrystallize under pressure may be an important factor in structural evolution, was pointed out by Drs. Paul Billingsley, Burton, Wash., and Augustus Locke, of San Francisco, consulting mining geologists. They found that as rocks under stress recrystallize they become more rigid, until eventually they resist further deformation, so that stresses must be relieved elsewhere by deformation.

STUDIES of deformation of the rocks of most regions are extremely complex, because each deformation is influenced by the "leftover effects" of all previous deformations, and tends to destroy some of the evidence of these earlier deformations. This is not true in the Philippine Islands, according to Dr. Edward H. Wisser, of San Francisco, who finds that only one deformation has occurred in the region since it was formed. Beginning at a time shortly after the building of the Rocky Mountains, shallow water sediments were deposited continuously until late in Miocene time (day before yesterday, geologically speaking). Then the region was compressed, so that to-day it is folded into ridges having a north-south trend, with the structures all clearly due to a single major deformation. With east-west compression, a north-south elongation of the folded sediments, which were in places more than three miles thick, is called for by theory. Dr. Wisser's field studies show that this elongation is actually present, and confirm

the theory which was derived from studies of more involved structures.

COLOR motion pictures, already used to illustrate medical and biological research reports, are useful in geological work, according to Dr. Chester R. Longwell, Yale University geologist. Dr. Longwell photographed the great Muddy Mountain and Keystone overthrust faults, in southern Nevada, where dark-colored ancient rocks have been pushed over bright-colored rocks of later age. Relations of the various rock beds in this near-desert region were strikingly shown by the color film.

WINTER WHEAT

DROUGHT, which has gripped the major crop areas of the country since late summer with hardly a let-up, has created a serious situation for the growers of winter wheat. Yet the danger of an actual shortage, or even the necessity for higher prices on flour and bread, is still remote, according to figures of the Bureau of Agricultural Economics, U. S. Department of Agriculture.

The present "wheat year" began on July 1, 1939, with a carry-over of 254 million bushels. To this was added a crop of 755 million bushels, making a total stock of 1,009 million bushels. After deducting domestic consumption and export (before the recent stopping of export subsidies) the carry-over anticipated for July 1, 1940, is 304 million bushels.

Winter wheat is expected to show a short crop because of the drought, but when there is a reduction in winter wheat there is always an increase in the acreage of spring wheat planted. The Bureau of Agricultural Economics expects this increase to amount to as much as 10 per cent. in the spring of 1940, and estimates a wheat crop of 600 million bushels—a decline of 155 million bushels under the 755 million of last year. This will bring the total stock at the beginning of the 1940 "wheat year" to 904 million bushels. The bureau anticipates a decline in domestic demand and in exports (if any) down to about 660 million bushels, which will leave a carry-over of 241 million bushels as of July 1, 1941.

The one thing that could cause a serious upset in the calculations would be a continuation of the present drought through the rest of this winter and into next spring and summer, damaging the spring wheat crop as severely as the winter wheat has already been harmed. However, no dependable system of forecasting thus far devised undertakes to peer that far into the future.

The crop weather of the year just closed was certainly full of surprises. At the outset of the growing season a severe spring drought covered most of the country, and Secretary Wallace appointed a special drought committee to deal with the situation. Then, in late May and June, heavy rains fell, and the drought committee rejoiced to find itself superfluous. The rains lasted until the summer-growing crops were well made. Then, about August 20, they stopped, and the drought that started at the summer's end is with us still in the middle of the winter.

A Broadside of NEW and VITAL Information!

New books full of new ideas and new methods of procedure are always an inspiration. They are particularly inspiring at the start of a new year. On this page are briefly described five books scheduled for early release. Written by outstanding men they merit your careful consideration.

ORTHOPEDIC SURGERY

Here is a handbook on orthopedic surgery based on the opinions, criticisms and suggestions of more than 25 outstanding orthopedic surgeons and teachers. The subject matter is arranged as follows: the first portion of the book to pathology—the final section being devoted to anatomical region, including disease entities which do not fall readily into the pathology grouping. By ALFRED RIVES SHANDS, JR., in Collaboration with RICHARD BEVERLY RANEY. 541 pages, 154 illustrations. Price, about \$5.00.

TUMORS IN CHILDHOOD

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OPERATIVE SURGERY

This new Fifth Edition contains many new features—new illustrations, new operative procedures. Descriptions of the operations are in narrative form, approximating the smooth regularity of an operation in progress. Throughout the aim is to preserve physiologic function. By J. SHELTON HORSLEY and ISAAC A. BIGGER. 5th Edition. 2 Volumes. 1500 pages, 1391 illustrations. Price, about \$15.00.

Management of OBSTETRIC DIFFICULTIES

This book deals with the diseases of the fetus, such as monstrosities, chorionepithelioma, hydramnion and oligohydramnion. A considerable portion is devoted to the diagnosis and treatment of abortion. The various methods of operative obstetrics are described, including forceps, caesarean section and mutilating operations on the fetus. By PAUL TITUS. 2nd Edition. 900 pages, 377 illustrations, 5 color plates. Price, about \$10.00.

Synopsis of OPERATIVE SURGERY

This new book is our answer to the demand for a low cost compendium on operative surgery—a book that takes up preparation, anesthesia, postoperative care, general considerations of surgical technic—and then describes surgery of skin, pericardium and heart, arteries, veins, amputations and disarticulations, bones, joints, muscles and tendons, head, spine and nerves, eye, ear, nose and throat, neck, thorax, abdominal wall, peritoneum, omentum, mesentery and gastrointestinal tract, liver and biliary system, pancreas and spleen, genitourinary tract. By H. E. MOBLEY. 400 pages. Illustrated. Price, about \$4.00.



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Greatest distress is anticipated among winter wheat farmers in the West. Over wide areas they had nothing but dust in which to sow their seed. The first serious cold wave of the winter, coming with the beginning of the new year, failed to damage the diminished crop because of a providential light snow that covered most of it. However, neither this nor later snows will suffice to produce a full crop, for the plants simply are not there. The country must depend on normal spring rains and a normal spring wheat sowing to make good the losses in the winter wheat regions.

HIGH BLOOD PRESSURE

(Copyright, 1940, by Science Service)

THE extract of healthy kidneys will bring back from the point of death patients suffering from high blood pressure, it has been discovered by Dr. Arthur Grollman, of the Johns Hopkins University School of Medicine, and Drs. Tinsley R. Harrison and John R. Williams, Jr., of Vanderbilt University School of Medicine. The extract may be to patients with high blood pressure what liver is to the anemic. Physicians are enthusiastic over this promise of a new life-saver for thousands of sufferers from high blood pressure, killer of more men and women than any other disease. Even cancer, tuberculosis and syphilis are not so destructive of human life as is this condition known to physicians as hypertension.

Tried first on rats, the kidney extract brought the blood pressure of those with hypertension down to normal. On normal rats, however, there was no lowering of blood pressure, and no toxic or other objectionable effects were observed even when the dose was set at four times that taken by the rats with hypertension. In rats in which the kidney had been cut off to produce experimental hypertension, the extract has another effect. These animals, for whom the high blood pressure was evidently a necessary condition for life, fell into a state of apathy, vomiting, staggering and finally died.

The extract is not yet ready for use as a medicine until further research and testing has been made. About twelve human cases ranging in age from 36 to 60 years have already received the treatment and have been brought out of a state of coma bordering on death when the blood pressure was brought down to a normal level.

If you are suffering from high blood pressure, don't bother to make yourself kidney stew. Eating kidneys won't lower your blood pressure, Dr. Grollman explained, because a ravenous appetite would be needed to eat the quantity of whole kidneys necessary for the medicinal effect and cooking would destroy the medicinal value. The extract is not difficult to take by mouth; in alcohol it is said to be quite palatable.

Apparently very similar in action to the extract used by Dr. Grollman and his associates is another substance reported for the same purpose by Dr. Irvine H. Page, of the Lilly Laboratory for Clinical Research of the Indianapolis City Hospital.

Renin, a substance contained in the kidney, Dr. Page has found, reacts with a substance in the blood to produce a third substance christened angiotonin. When either renin or angiotonin is injected into the blood stream, an

inhibitor is liberated, and such an inhibitor also has its origin in the kidney. These serve to counteract renin and prevent or cure hypertension.—MARJORIE VAN DE WATER.

A NATIONAL NEUROPSYCHIATRIC INSTITUTE

(Copyright, 1940, by Science Service)

SURGEON-GENERAL THOMAS PARRAN, of the U. S. Public Health Service, proposes in his annual report, transmitted to Congress on January 6, to establish a National Neuropsychiatric Institute. This institute would be modeled after the National Cancer Institute, where a staff of trained investigators are searching for knowledge leading to methods of controlling cancer.

Mental and nervous diseases and epilepsy together represent the largest unsolved problem in medicine according to the report. Hospitals caring for mental disease have on their books more than 500,000 patients, and more than 117,000 additional patients are in hospitals for mental defectives and epileptics. The aging of our population will tremendously increase the total number of sufferers from mental disease.

Surgeon-General Parran pointed out that by 1980 it is predicted that we shall have only half the people under nineteen years of age that we have now and twice as many over the age of sixty-five years. The incidence of mental disease in the age group over sixty-five years is ten times what it is in the group of nineteen years and under. A little mathematics will show how much more mental disease we shall have then than now. We must start now to work out methods for preventing mental disease to help avoid such a load in the future.

"Recent developments showing the influence of certain vitamins, such as nicotinic acid, in relieving cases of insanity not heretofore recognized as being of dietary origin open many possibilities for further research not only of accessory food factors but of other phases of body metabolism, such as hormones. The impression is growing among psychiatrists that constitutional and metabolic factors may play a rôle in forms of insanity heretofore thought of as being of psychic origin." The effects of insulin shock treatment now used in one form of mental disease, schizophrenia, which are like "taking the veil from the patient's eyes, transporting him from a vegetative state to an apparently normal one for a time," cause a great disturbance of body metabolism. All these factors indicate the need for physiological research on mental and nervous disorders.

The proposed Neuropsychiatric Institute would be built on the present site of the New York Marine Hospital, giving the staff access to patients and to the library facilities of the metropolis, and the advantages of working under the "stimulating influence of extensive activities and informed personnel in the nervous and mental disease field." The plans call for 350,000 cubic feet of laboratory space for fundamental research and access to 200 patients for clinical study. It is also suggested that the institute should have funds to allot to competent groups throughout the country for research on the problem of nervous and mental disease and epilepsy, and that a national advisory council, similar to the National Advisory Cancer Council, should be established.—JANE STAFFORD.

A NATIONAL AIRPLANE ENGINE RESEARCH LABORATORY

(Copyright, 1940, by Science Service)

CONSTRUCTION of a national airplane engine research laboratory is urgently recommended in the twenty-fifth annual report of the National Advisory Committee for Aeronautics, made public on January 8.

Through a sub-committee, whose chairman was Colonel Charles A. Lindbergh, it is found "that there is a serious lack of engine research facilities in the United States, and that it is of the utmost importance for the development of aviation in general, and for our defense program in particular, to take immediate steps to remedy this deficiency."

Emphasizing this suggestion, the National Advisory Committee for Aeronautics, through its new chairman, Dr. Vannevar Bush, president of Carnegie Institution of Washington, continued: "The reason for foreign leadership in certain important types of military aircraft is due in part to the superiority of foreign liquid-cooled engines. At the present time, American facilities for research on aircraft power plants are inadequate and can not be compared with the facilities for research in other major fields of aviation."

While the committee did not cite specific examples of foreign planes in the "leadership" class, it is believed that Messerschmidt fighters, Heinkel pursuit-fighters and Junkers and Heinkel bombers—all of which are powered with liquid-cooled engines—would be typical planes of the class to which the committee referred.

Aircraft design and research will ultimately replace the Atlantic and Pacific Oceans as the best bulwark for the defense of the United States, according to the report. Pointing out that the nation is most fortunately situated between two great oceans, it reads: "However, as advances in aeronautical science result in increased range of aircraft the significance of these oceans will gradually diminish and superiority in aircraft design will become more and more essential to our national safety."

The most significant event of the year, for the future of American aviation, was the authorization of a second major research laboratory to be established at Moffett Field, Calif., some thirty-eight miles south of San Francisco.

Further details of what has become known as the "500-mile-an-hour wing" for airplanes were also described in the new report. Research scientists at the Langley Field, Va., laboratory have discovered "a new principle of wing design in which the transition from smooth (laminar) flow to turbulent air flow over a wing was so delayed as to reduce . . . basic air resistance by approximately two thirds. So far the application (of this achievement) is limited to small airplanes, but there are indications of its ultimate applicability to larger airplanes through continued research."

ITEMS

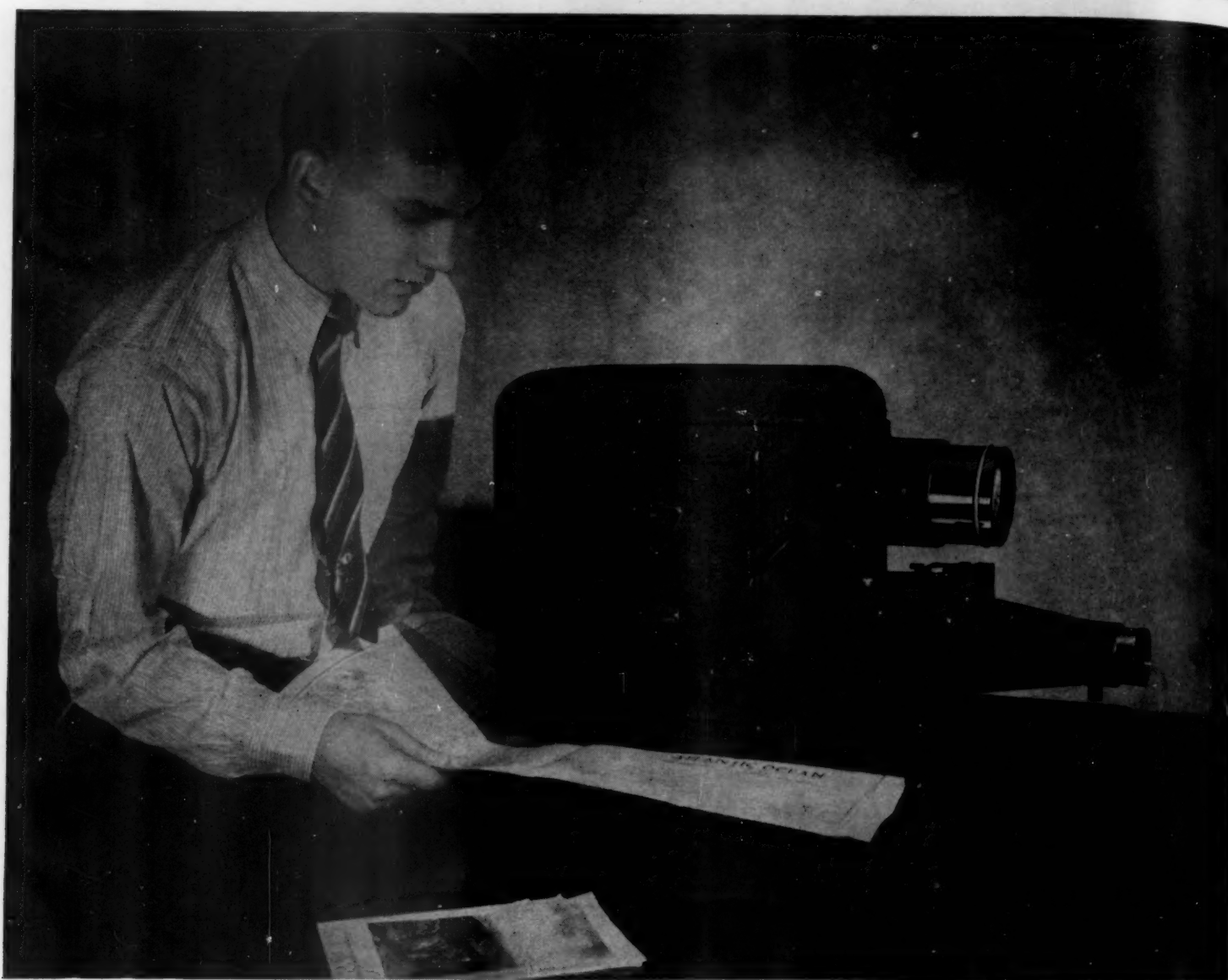
WAR in Europe is interfering with weather reporting in the North Pacific area. The U. S. Weather Bureau reports increased difficulty in making good weather maps for the benefit of vessels in waters off the northern Pacific coast of the United States, as well as for areas ashore in

the Pacific Northwest. Reason is the total radio silence of ships of British, Canadian and other Empire registry all over the world, as well as greatly reduced communication even from Japanese, Norwegian and other neutral shipping. Weather data radioed from such ships formerly supplied basis for far wider and more accurate reporting and forecasting of marine and coastal weather than is now possible. Only American ships are still untrammelled sources of meteorological data at sea.

ONE of the most active sun-spot groups for nearly a year, swiftly growing and easily visible to the eye through smoked glasses, has ushered in the year 1940, according to astronomers at the U. S. Naval Observatory. First sighted as a solitary sun-spot on December 31, with an area of only a quarter of a square degree, the group has grown actively each day. On January 4 it contained forty spots and had a size of twenty-eight square degrees, more than a hundred times its original area. There is a distinct possibility that the new year's sun-spot inauguration will disturb, or even-disrupt, transatlantic short-wave radio communication. Scientists have discovered that the activity of a sun-spot group—its speed of growth—is frequently associated with radio "blackouts." So if you have a short-wave receiver that fails to bring in Berlin or London in the next few days don't blame the set too much. Perhaps it will be caused by 1940's first big sun-spot outburst.

HINT of a coming epidemic of influenza appears in reports to the U. S. Public Health Service. The number of cases has been steadily increasing ever since October and during December ran from 1,000 to 5,000 cases higher per week than during the five-year median for the same period. For the week ending December 30 there were 4,836 cases reported, but two states, among them South Carolina, which has had the highest figures, have not yet reported. The week of December 16, there were 6,455 cases reported throughout the nation, 2,353 of them in South Carolina. The number fell during the week of December 23, and dropped still lower during the week of December 30, but incomplete reporting during the holidays may account for this.

SLOW neutrons from the atom-smashing cyclotron, of the kind used in the spectacular splitting of the uranium atom, are five times as effective against cancer as the fast neutrons which are already showing promise as anti-cancer weapons, is announced at the University of California. The new, slow-neutron attack on cancer is far from the stage of being used in treatment of human cancer sufferers. It was developed in test-tube experiments with cancer tissue removed from the body by Dr. P. G. Kruger, of the University of Illinois, now working with the cyclotron at the University of California. In the new process, fast neutrons coming from the cyclotron are slowed down by passing through a thick block of paraffin. These slow neutrons then enter a test-tube containing cancer cells in a solution of boric acid. The boron atoms of the boric acid capture neutrons which break down the boron into helium and lithium. These fly off and lose their energy in the malignant or cancer tissue and in so doing, destroy its malignancy.



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SCIENCE NEWS

Science Service, Washington, D. C.

THE PERKIN MEDAL OF THE AMERICAN SOCIETY OF CHEMICAL INDUSTRY

(Copyright, 1940, by Science Service)

DR. C. M. A. STINE, vice-president in charge of research of E. I. du Pont de Nemours and Company, of Wilmington, Del., the chemist who initiated the research of making big molecules out of little ones that led to the discovery of nylon, the remarkable organic material out of which chemistry can make anything from sheer silk-like stockings to toothbrush bristles and fishline leaders, was presented, on January 12, with the Perkin Medal of the American Section of the Society of Chemical Industry.

In his address following the presentation, Dr. Stine traced the rise of America's great organic chemical industry of to-day from its virtual birth at the time of the World War in 1914.

Directly or indirectly from the results of intensive research in organic chemicals have come the following advances: Modern plastics, motion picture film using synthetic camphor, medicinal chemicals like sulfanilamide and sulfapyridine, superior dyes, improved cheap and safe refrigerant fluids like Freon, a vast improvement in the wear of automobile tires, the development of synthetic rubber, safety glass, tougher and more oily oils and lubricants for motor cars, superior gasolines and fuels, better and safer explosives, synthetic urea for fertilizer for agriculture and the new plant hormones and vitamins.

Dr. Stine stated that contrary to popular belief, American chemical industry was large prior to the war, but mainly in the inorganic chemical field. As early as 1865 its products had a valuation of some \$60,000,000. In 1910 the United States produced three times as much sulfuric acid as Germany and twice the amount of alkalis made in England.

In organic chemicals, however, the United States was sadly lacking at the start of the war. The great industry which has been created since that time, in this field, represents an enormous investment of American money and American brains in research. Dr. Stine pointed out that in the case of the du Pont concern alone, \$40,000,000 was invested in research before a cent of profit was realized.

Dr. Stine challenged those who maintain that present national and international ills are the result of too much scientific development. These people overlook, he said, "the horrible wars that have been waged all down the years when there was no science as we know it to-day. They overlook or wilfully ignore the well-recognized fact that the lust for power by one man, or a small group of men, leads all too frequently to that great social and economic disaster called war. Until indoctrinated race antipathies and hatreds, envy and greed for power are eliminated from human nature through spiritual regeneration, we shall have no solution of this fatal disease which afflicts humanity. Science, though it is able to confer the richest blessings upon mankind, is not able to change the heart of man and insure that the great increases in scientific knowledge will be beneficently applied. But

while this is unquestionably true, I nevertheless hold that the great contribution which the development of the organic chemical industry has made to the self-sufficiency of this country is a definite contribution toward the maintenance of peace."

THE MESON PARTICLES OF COSMIC RAYS

(Copyright, 1940, by Science Service)

A NEW kind of atomic particle that would make "triplets" out of the "twin" meson particles found in cosmic rays is suggested by Professor Hans A. Bethe, of Cornell University, who worked out the theory of how the sun keeps shining.

Professor Bethe has been applying his skill in mathematical physics to calculations on how meson particles—having 200 times the mass of ordinary charges of electricity, the electrons—can be used to explain nuclear forces. These attractive forces within the nucleus help hold all atoms, and hence all matter, together and form a sort of "cement" that binds together the atomic building blocks of the physical world.

That meson particles might exist and have the rôle of transferring energy between nuclear particles was first suggested in 1935 by the young Japanese physicist Yukawa. This was before the particles were actually found in cosmic radiation.

Professor Bethe's calculations show that for an atom to liberate a meson particle would require from 80,000,000 to 100,000,000 electron volts of energy. This is far beyond any energies yet available in the laboratory through bombardment by giant machines for smashing the atom.

The new triplet kind of meson, yet unfound but needed to explain more fully nuclear forces, would be without an electrical charge, according to Professor Bethe. Mesons with positive and negative electrical charges—the twins—are already known to exist.

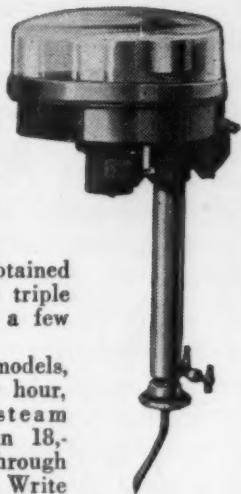
SYNTHETIC HORMONES

LEAVES, roots and other parts of a plant live under a democratic régime, as contrasted with the totalitarian state of an animal's body, wherein all parts are kept in strict subjugation and control by the central nervous system. This contrast was presented by Professor F. W. Went, of the California Institute of Technology, at Lehigh University, in a lecture on January 15 under the auspices of the Society of the Sigma Xi.

Although an all-powerful central control is lacking in plants, they do not live in a state of anarchy, Professor Went pointed out. The democratic system of checks and balances, the pride of American constitutional development, is paralleled in plants by a system of internal secretions or hormones, whereby growth and other processes in one part are stimulated yet kept in control from other parts of the plant body. Thus, the auxins that promote root growth are manufactured in the tips of the growing shoots. Mature leaves make hormones that influence the growth of younger leaves, and also other hormones that determine the formation and blossoming of flowers.

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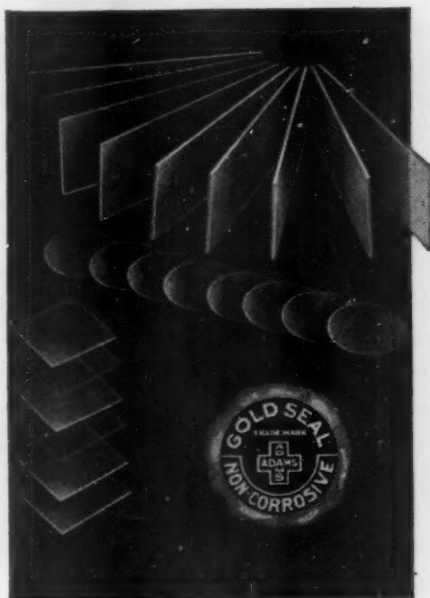
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LANCASTER, PENNSYLVANIA

It has been possible to isolate and analyze a few plant hormones and by testing similar synthetic compounds of increasing chemical complexity it has been learned what molecular groupings are effective in stimulating plant life processes. Professor Went likened this process to a close mechanical analysis of a key, to determine just which wards tumble given pins in a lock.

This analysis of plant hormones has made possible the artificial synthesis of growth-promoting substances like the now famous indole acetic acid, which enable man to control growth processes to his own liking and advantage instead of letting plants grow in their own naturally proportioned, internally controlled way. Thus far only a beginning has been made, in such relatively simple operations as inducing root formation on otherwise obstinately non-rooting cuttings, spraying trees to prevent abnormal dropping of immature fruits, and so on. But the possibilities for future development along this line appear to be practically without limit.

THE BUHL PLANETARIUM

By patiently running the Buhl Planetarium machine back through 5,200 years of sky history, until it flashed on the ceiling the star-picture seen by Egyptians the night of June 18, 3251 B.C., Dr. Jotham Johnson, the University of Pittsburgh archeologist, claims that he has found the exact date when Egypt's famous calendar started.

Egyptians had no Leap Year provision, which explains why their calendar got out of step with the sun, and which also has given historians a clue to the date when their 365-day calendar must have been invented. "Lacking a Leap Year, the Egyptian calendar fell back one day every four years," explains Dr. Johnson. "And in 1,456 years, their calendar slipped back an entire year. That 1,456 years of slipping back is called the Sothic Cycle. We know, by authenticated written records, that a Sothic Cycle ended in 139 A.D."

Counting back, historians have speculated that the Egyptian calendar might have started 4229 B.C. or 2773 B.C. Dr. Johnson considered one of these dates too early, because Egypt was too primitive then, and the other date too late in Egypt's civilization. He pinned his theory to 3251 B.C. and seized an opportunity to check it when the Buhl Planetarium machine could be run backward for ten hours to reach such ancient sky patterns.

Historians, he says, are certain that Egyptians started their calendar when Sirius, the Dog Star, brightest star in the sky, appeared over the eastern horizon just before the sun came up. The natural time of year for the Egyptians to start their calendar, he adds, was when the Nile flood began, soon after the middle of June. Dr. Johnson sought, therefore, for Sirius to appear just before dawn in the mid-June sky picture of 3251 B.C., and to his delight the planetarium confirmed his theory.

Additional evidence for his theory, he reports, is finding that a thin new moon appeared that night in the west just after sunset. Since the earlier Egyptian calendar had been a primitive one based on the moon, it would be natural, he explains, for them to want to change smoothly to a sun calendar, and this would mean choosing some night when a new-moon month was beginning.

ELECTRIC SHOCK TREATMENT FOR MENTAL PATIENTS

USE of electric shock treatment for mentally sick patients is announced by Dr. Lothar Kalinowsky, of Rome, in a report to *Lancet*.

The treatment is like the now widely used insulin and metrazol shock treatments. Instead of injecting either of these shock-inducing drugs, an electric current is passed through the patient's head to induce the fits, or convulsions, which restore the patient to sanity, for a time at least. Treatment is said to be much easier on the patient, and also on the nurses and attendants, than the metrazol or cardiazol shock treatments. Nor is there any danger from the amount of current used to induce the fits.

Dr. Kalinowsky states that "Several thousand fits have been produced on some hundred patients, partly treated in the Rome clinic and partly reported from other institutions, without any accident whatever." The number of patients treated is still too small and the time since treatment is too short to allow definite conclusions as to the curative value of this method. According to information given by several institutions it can only be said that the number of recovered and improved cases of schizophrenia corresponds at least to that of the remissions of cases which, in the same clinics, were treated with cardiazol (metrazol).

All the disagreeable sensations patients complain of with metrazol treatment are said to be missing with the electric shock method. The patient always loses consciousness and awakens slowly, with no memory of the experience. No fractures, dislocations or ruptured muscles have been seen, though Dr. Kalinowsky admits that they could occur.

Electrodes are put on both sides of the patient's forehead, animal studies having shown that the temples are the best place for the treatment. Currents of 70 to 110 volts and 300 to 600 milliamperes are generally needed to produce fits. The shock is given for one tenth of a second.

REFLECTION FROM THE EYES OF ANIMALS

ANIMAL'S eyes don't shine in the dark; they must have at least a little light to produce that often startling gleam, for they shine only by reflected light. Such are the indications of a study made on hundreds of specimens in the National Zoological Park in Washington by Ernest P. Walker, assistant director, and reported in the new year-book of the Smithsonian Institution.

Eyes of different species reflect light in widely differing ways. The eyes of alligators and crocodiles "give one the impression that he is looking into a brilliantly glowing pinkish opening in a dull-surfaced bed of coal." Some smaller rodents have eyes that shine "like an illuminated piece of amber."

Apes' and monkeys' eyes do not reflect light at all. Mr. Walker found, and he got only a faint reflection from the eyes of the ring-tailed lemur, one of the more primitive members of the ape-monkey family, the primates. Studies by other investigators have shown that only the rarest exceptions among human eyes have reflecting power.

In making his studies, Mr. Walker went about the Zoo

at night, with a small flashlight lamp in a reflector on his forehead, using a three-cell battery in his pocket as current source. He tried varying the color of his light, but obtained nothing particularly striking in this way.

Previous studies on the eyes of animals at night have been conducted only in the field, so that it has not always been certain what animals were seen, and it has never been possible to go back and check up a second time on the same individual. By working in the Zoological Park Mr. Walker has been able to obtain more numerous and more carefully verified records.

SAFETY FUELS FOR AIRPLANES

(Copyright, 1940, by Science Service)

A NEW type of safety gasoline for aviation that would be more volatile than kerosene and hence less hazardous from the explosion standpoint, was described at the meeting in Detroit of the Society of Automotive Engineers by Robert E. Ellis and William J. Sweeney, of the Standard Oil Development Company.

Back in the days when the U. S. Navy had the *Akron*, *Macon* and other great airships, safety fuels were seriously considered. These airships were inflated with helium to decrease their fire risk and a gasoline was sought which would vaporize only a little and could be used to cut the kill hazard from fuel still further.

The disasters to Naval airships and the urge for superior high-octane gasolines for airplanes were twin reasons why interest in safety fuels diminished after 1932, although in that year the capacity for the production of such safety fuels reached tank car lots. New advances in petroleum refining since 1932 have, however, made it possible to produce safety fuels with very high octane (anti-knock) rating up to 100 octane number. These safety fuels have a flash point, the temperature at which their vapors will ignite, of 100 degrees Fahrenheit. In contrast, the flash point of many gasolines is below room temperature and, in some cases, is as low as minus 30 degrees Fahrenheit.

In their analysis of crude petroleum sources suitable for making safety gasolines, Messrs. Ellis and Sweeney find that if the proper equipment were installed, a production of 10,000,000 barrels of such fuels could be produced each year, an amount sufficient for the needs of aviation for many years to come.

Stopping point for the immediate introduction of these new safety gasolines is that they can not be burned in an ordinary type of engine using a carburetor. It is necessary to supply the fuel to the engine by injection methods.

ITEMS

INFLUENZA is continuing its disturbing rise, suggestive of a coming epidemic, according to reports made to the U. S. Public Health Service. For the week ending January 6, the latest on which reports are available for the entire nation, there were 9,630 cases. This is an increase of more than 2,500 cases during the week. South Carolina, North Carolina and Georgia were particularly hard hit, South Carolina reporting 3,154 of the nation's total number of 'flu cases.

WIDE-SPREAD rain over most of the Ohio Valley, with

mostly non-freezing temperatures, is expected to wash away a great part of the snow that now blankets the region, and may give that river a start toward one of its winter floods. The crucial hours will come when colder weather moves in from the northwest. If the new low temperatures come soon enough and are sharp enough, the partly melted snow will be stopped on thousands of hillsides before it has a chance to slip into the creeks and thence into the larger streams.

THE USSR is now the world's third cotton-producing country, with 600,000 bales out of last year's world total of 3,250,000, and ranking just behind the United States and India, according to the German journal, *Die Umschau*. Russia's new and vast cotton plantations are in southern Siberia, south of the line between the Caspian Sea and Lake Balkhash. Railways are available for bringing the crop into European Russia.

HEMP without marihuana is sought by plant breeders of the U. S. Department of Agriculture as basis for a new all-American cordage industry. New grasses to hold soil against rising up into dust-storm clouds are another goal of government research. So also are early, hardy tomatoes suitable for cultivation in the Great Plains area. These are samples of the practical researches reported in the recently issued annual report of the chief of the Bureau of Plant Industry to Secretary Wallace. More than a hundred scientific investigation projects are discussed.

THE belief that onions will check the growth of food-spoiling germs, especially in pickles and relishes, got scientific confirmation and esthetic condemnation in research was reported by Professor James E. Fuller, of the Massachusetts State College, Amherst, at the recent meeting of the Society of American Bacteriologists. Onion juice sterilized by filtration (not by heat) can prevent the growth of certain bacteria that commonly contaminate food, including food-poisoning bacteria. However, the required concentration of juice is so great that its sterilizing value is of little, if any, practical value.

SYNTHETIC vitamin E—so-called reproductive vitamin because it aids fertility in rats—is entering clinical tests on human beings, according to Professor Lee Irvin Smith, of the University of Minnesota, who synthesized it. "It would be quite premature to say that vitamin E is a cure for any kind of sterility," Professor Smith said. Definite statements regarding vitamin E therapy must await extensive clinical results. "The clinical side of vitamin E research has just begun. With a plentiful supply of the synthetic vitamin available, representing a standard preparation of known and uniform potency, it is to be hoped that the clinical work will proceed rapidly so that the usefulness, as well as the limits, of vitamin E therapy may soon be known. It must be remembered that most of the biological data in connection with vitamin E have been obtained by using rats as test animals, and statements regarding what the vitamin will do in the treatment of human diseases or diseases of animals other than rats, are founded on very few examples plus the assumption that other animals will respond as rats do."



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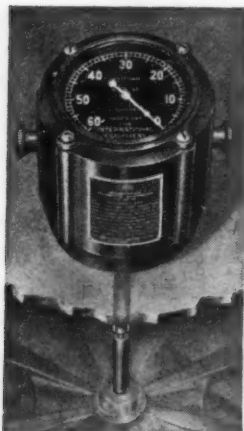


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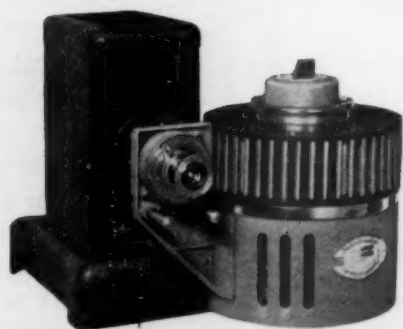
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LANCASTER, PENNSYLVANIA

SCIENCE NEWS

(Science Service, Washington, D. C.)

EROSION IN PALESTINE

PALESTINE, traditionally a land of milk and honey, has been turned into a land of stones and poverty largely by bad farming, which permitted erosion to ruin its soil, according to an address by Dr. W. C. Lowdermilk, assistant chief of the U. S. Soil Conservation Service. Dr. Lowdermilk recently returned from a long study trip into the lands of old cultivation, of North Africa and the Near East.

A typical scene which he depicted is a once-fertile hillside area on the road from Beersheba to Jerusalem. The soil is now washed off the slopes to bare rock and lodged in the valleys, Dr. Lowdermilk pointed out, and he continued: "There soil material has been sorted by storm waters each winter; the fine and fertile particles have been swept out to sea to change the beautiful blue of the Mediterranean to a dirty brown. The coarser material is spread out on former alluvium, where it is still available for cultivation. But more than this, the flashy run-off from the heavy winter rains on the bared slopes gullies the alluvium. The area of useful land has been progressively reduced."

The ruin that ignorant, greedy or poverty-desperate farming brought to the soil has been clinched and deepened throughout the Mediterranean region by the cutting hooves and close-shearing teeth of the ubiquitous flocks of goats, that bite off and trample down every hopeful scrap of vegetation that might otherwise check the millennial erosion.

European agronomists living in the now arid regions are coming to a realization that considerable parts of the North African desert may have been man-made. Where now are only waste lands and ruined ancient cities, there were once great farms and groves that exported wheat and olive oil to Rome, and large and thriving populations. Dr. Lowdermilk told of one French scientist in Algeria, who had come to question whether any great change in climate has occurred there since Roman times. He planted some young olive trees on a hill, watered them through their infancy, and then left them to take care of themselves. They are still alive and bearing good crops of olives, as their ancestors on the same hills did for Imperial Rome.

Summing up, Dr. Lowdermilk urged that land be considered "not as an economic commodity but as an integral part of the corporate existence of a nation as its people are."

POLARIZED LIGHTS FOR AUTOMOBILES

(Copyright, 1940, by Science Service)

How the automobile industry might solve the problem of introducing polarized headlights to eliminate night-driving glare was described at the meeting of the Society of Automotive Engineers in Detroit by P. J. Kent, chief electrical engineer of the Chrysler Corporation.

An agreement among manufacturers to install polarized lights on new cars after a given date would be the initial step. At the same time demountable polarizing screens

for old car windshields could be made available to allow the beneficial polarizing, glare-eliminating effect for them also.

However, Mr. Kent pointed out, it would probably also be necessary to have new cars equipped, for a few years at least, with a standard beam-depressing switch so that their strong headlight rays could be lowered in meeting old-type cars. This depression of the beam would be needed until the old cars came to a lingering death and the end of their usefulness. Polarizing screens on headlights and windshields would be "crossed" so that the polarized light rays could be extinguished and glare eliminated.

Still debatable, said Mr. Kent, is the question of whether headlight intensity would have to be stepped up with the introduction of polarized beams. The polarizing screens cut the light intensity emitted by the headlight some 60 per cent., he pointed out. It has been suggested that brighter headlights could overcome this absorption and also surmount the additional absorption of 60 per cent. encountered in the windshield screens.

The engineering problems involved in the switchover to polarized headlights are major ones and require considerable testing before they can possibly be applied to all automobiles. The problem is by no means as simple as the introduction of safety glass in cars, for polarizing the headlight beams can only gain its effectiveness if all cars possess the new invention. The benefits of safety glass, in contrast, were real and tangible immediately on its installation in any single car without respect to others.

THE SPREAD OF INFANTILE PARALYSIS

(Copyright, 1940, by Science Service)

NEW leads on research in infantile paralysis make the eventual conquest of this disease seem excitingly near at hand. Research plans announced by Basil O'Connor, president of the National Foundation for Infantile Paralysis, show that investigators are following new trails in their search for ways of preventing the disease.

Saliva from mouths of infantile paralysis patients both before paralysis sets in and during the paralytic stage will be examined for the virus that causes the disease. The clue for this line of search comes from the recent discovery of the virus in sewage from localities that were gripped by infantile paralysis outbreaks. The virus was also discovered in the intestinal discharges of patients and of healthy persons who did not have infantile paralysis, but who had been in contact with patients. This proved the existence of healthy carriers of infantile paralysis, akin to the healthy carriers of typhoid fever.

How do the healthy carriers and the patients spread their germs to others? The saliva tests may give the answer to that question. Infantile paralysis, it is now believed, spreads more like diphtheria than like typhoid fever. In infantile paralysis, as in diphtheria, there must be direct contact with a patient or a healthy carrier of the germs. In typhoid fever, water or food may spread the germs, which are discharged from the body with its waste matter.

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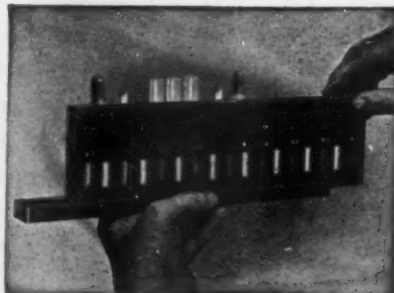
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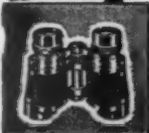


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A HISTORY OF WOMEN'S EDUCATION IN THE UNITED STATES

By **THOMAS WOODY**

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If infantile paralysis germs, discharged with body wastes, were spread by water or food, it would be expected that every one who used the same water and food supplies would get the disease during epidemics. But they do not.

Another unsolved mystery is where does the virus go in the body of patients. Where do healthy carriers carry their germs? It is known that the virus travels along nerves, and that when it reaches the nerve cells in the brain and spinal cord it does its chief damage. But for all that is now known, the virus may invade other tissues of the body and hide itself there. Complete information on this point will be sought by examination of all the tissues of the bodies of patients who die of the disease.

If infantile paralysis virus travels from human wastes to contaminate water supplies, will chlorination make the water safe by killing the germs? Investigators believe it will, but when they began thinking about this, they realized that germ-killing chemicals, from carbolic acid, or phenol, down are tested by their power to kill germs that can be seen under the microscope, like the colon bacillus, but not against the invisible virus type of germ. This has led to another line of research, testing the virus-killing power of chemicals, which may help with the problem of infantile paralysis and of other virus-caused diseases.—JANE STAFFORD.

SERUM FOR ROCKY MOUNTAIN SPOTTED FEVER

(Copyright, 1940, by Science Service)

SERUM that may prove a cure for dangerous Rocky Mountain spotted fever, the tick-borne disease that every summer threatens ranchers in the far West and suburbanites on the Eastern seaboard, has been made by Dr. Norman H. Topping, of the National Institute of Health of the U. S. Public Health Service.

The serum, so far used only on guinea pigs and monkeys, is "the first definite hope of a specific treatment for Rocky Mountain spotted fever." Guinea pigs and monkeys survived usually fatal doses of spotted fever virus when treated after they became sick with blood serum from rabbits that had been immunized to the virus. Details of the preparation of the serum are reported by Dr. Topping in the current issue of "Public Health Reports."

Public health officials hope the serum will prove as useful in treating human patients, but that can not be determined until more of the serum has been made. The federal health service has recently announced a new method of making a vaccine to protect against Rocky Mountain spotted fever. The advantage of this new vaccine over the old one is that it can be made on a large scale. The difficulty and danger of making the old vaccine limited the amount that could be made, and thus its usefulness.

Neither the vaccine nor the serum, however, is yet available for general use. Further tests must still be made with them.—JANE STAFFORD.

MEDICAL CARE

(Copyright, 1940, by Science Service)

A WARNING that we must now make haste in working out plans for better medical care distribution, to avoid having the problem become a political football, is issued

by Dr. Hugh Cabot, of the Mayo Clinic, in his book, entitled "The Patient's Dilemma," published by Reynal and Hitchcock.

Dr. Cabot incidentally criticizes the American Medical Association for failing, in its handling of economic, social and political problems relating to medicine, to maintain its high standards and the judicious and judicial qualities which have characterized its handling of scientific problems. But Dr. Cabot's chief concern is in solving the patient's dilemma of being unable to find or to pay for good medical care.

The approaching presidential election makes speed essential, Dr. Cabot points out, if the problem of getting medical care to all the people is to be solved by sound plans. With large bodies of people convinced and certain to state clearly their convictions that some change in medical care distribution is overdue, "the time appears to me," Dr. Cabot says, "to be short during which good-tempered discussion can hold the floor. Once the issue is joined between the political parties, action—possibly hasty—may well result."

No formula for solving the problem exists. Disagreeing with proponents of compulsory health insurance, Dr. Cabot states that while there is "much foreign experience to guide our footsteps, there is no foreign formula which can be applied—even in its general principles."

"The entrance of government into the distribution of medical care," he continues, "must have as its first step a secure foundation in the provision of a good personnel, good standards and expert supervision."

Dr. Cabot seems to favor solving the problem largely at the state level. He says there is much to be gained by regarding the states "as a series of experimental laboratories." Local initiative, local financing with state grants-in-aid to communities needing it, a single state administrative channel and state maintenance of standards are the principles he suggests for plans for medical care under government auspices.

Establishment and maintenance of fundamental standards, however, in his opinion, can only be done by the Federal Government. The Federal Government should also be responsible for expert determination of the relative needs of various portions of the country, and he favors following the "well-established principle that the more prosperous portions of the country should give aid and assistance to their less prosperous neighbors."

A federal department of health with a secretary of health in the cabinet, often proposed, is viewed with some alarm by Dr. Cabot. While he favors a single agency to administer all problems in the field of education, research and medical care in which the Federal Government is involved, he thinks these problems should be combined under the U. S. Public Health Service, which in turn should be under some major department of government. This will insure the supremely important permanency of tenure, detachment of view and freedom from political influence which might be threatened by setting up a department of health with a secretary in the cabinet.

THE WHITE HOUSE CHILD CONFERENCE

CLOSING its reports and polishing off recommendations and plans, the White House Conference on Children in a

Democracy adjourned on January 20, leaving the country with advice that any pending nation-wide economy wave should not sweep over 36,000,000 children first.

In 21 pages of compressed terms, the conference set forth recommendations that groups and individual citizens throughout the country may use, if they will, to work for the welfare of the rising generation. Like three previous White House conferences held at approximately ten-year intervals, the work of this group of experts looks ahead for ten years.

Its recommendations include such items as:

Large-scale slum clearance and low-cost housing under Federal leadership.

Further development of aid to dependent children, enabling families that need this aid to provide adequate care.

Legislation by state and city governments, to make it possible for them to cooperate with the Federal Government in housing programs.

More effective school health education and supervision. Minimum wage standards for all employed minors.

Abolition of industrial home work, which is seen as the only way of stopping children from doing such labor.

Substantial financial assistance by every state to its local school system, to equalize tax burdens and give the children equal chances for schooling.

Backing a long list of tersely worded improvements, reflecting present shortcomings as seen by physicians, teachers and welfare specialists, have been such outspoken statements to the conference as that by Professor C.-E. A. Winslow, professor of public health at Yale University. He reported that while the United States has made encouraging progress in saving 40,000 infant lives each year in the past decade, and reducing deaths of mothers, the health of school children shows no such cheery picture. "Even in our cities," said Professor Winslow, "more than a quarter of the children suffering from disease so serious as to disable them for a week or more receive neither medical nor hospital care of any kind. There is no economy in saving dollars at the cost of the lives and health of our children." Professor Winslow advocated the passage of a National Health Bill and an appropriation for continuance of the housing program by the present Congress, and voiced approval of the proposal that a National Nutrition Committee be appointed by the President of the United States.—EMILY C. DAVIS.

ITEMS

COMPLETELY out of the news has been the extremely severe submarine earthquake which occurred about 350 miles off Guam, in the Pacific on January 16. The extremely severe shock in Turkey just after Christmas, with its terrific death toll now estimated in the 40,000's, made the newer Pacific quake seem light but, in reality, it was two thirds as severe as the Asia Minor shock. Epicenter of the Pacific earthquake was at latitude 17 degrees north, longitude 148 degrees east, according to the U. S. Coast and Geodetic Survey. Seismological observatories from Indo-China to Weston, Mass., and from Sitka, Alaska, to Tucson, Ariz., reported the quake.

WAR has cast a new shadow of danger over ships plying

North Atlantic steamer lanes, by hampering the work of the International Ice Patrol. This patrol, which usually begins in late March, is conducted by special U. S. vessels but is internationally sponsored, and it depends for full efficiency on radio reports from merchant ships sighting icebergs. Now, to avoid being located by Nazi submarines, all British and French vessels, and many neutral ships as well, maintain complete radio silence. A statement in the Hydrographic Bulletin issued by the U. S. Navy Department takes cognizance of this situation, and requests that "In the interests of safety to shipping in general, the Hydrographic Office would appreciate receiving reports of ice sighted by such ships, immediately upon arrival in port."

AN American ship will be dropping depth charges in the North Atlantic for the next six weeks, but they will not have anything to do with the European war. The ship is the *Atlantis*, research vessel of the Woods Hole Oceanographic Institution. Her depth charges go clear to the bottom and explode there, setting up small earthquake-like waves which are picked up by specially constructed seismographs, also resting on the bottom. The records will give information regarding the nature and thickness of the rock layers that form the ocean bed. The method was invented by Dr. Maurice Ewing, of Lehigh University. Unlike the gray-painted or camouflaged warships, that are made as nearly invisible as possible, the *Atlantis* is painted white, purposely to make her conspicuous. The *Bulletin* of the Hydrographic Office, U. S. Navy, advises all shipping to give her a wide berth in order not to interfere with her scientific work.

GREAT canyons under the sea, extending many miles from shore, and sometimes reaching depths of more than two miles below sea level, still puzzle geologists, although recent findings, reported to the Geological Society of America, have considerably lessened the mystery of their formation. Once believed to be extensions of to-day's river valleys, cut during a time in the ice ages when sea level was lower than at present, these submarine canyons have been used as evidence of a very great lowering of sea level. Now, Drs. F. P. Shepard, of the University of Illinois, and H. T. Stetson, of the Massachusetts Institute of Technology, find that some of the canyons are not related to present valleys, that there is no good evidence of any two-mile lowering of sea level during the ice ages, when the cutting is believed to have taken place, and that the cutting took place earlier in the glacial period than has heretofore been believed. Tsunamis—great waves that originate on the sea floor—may have excavated these submarine canyons, in the opinion of Dr. Walter H. Bucher, of the University of Cincinnati, who shows that such cutting by these great waves—from fifteen to one hundred and twenty miles long—is certainly not physically impossible. Submarine earthquake disturbances, the cause of tsunamis, have been numerous in the Atlantic in geologically recent times, creating, among other features, changes in the submerged contours of the mid-Atlantic ridge, the rocky "centerboard" in the Atlantic basin.



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SCIENCE NEWS

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SOME PAPERS READ AT THE COLUMBUS MEETING OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE AND ASSOCIATED SOCIETIES

A NEW low-cost "atom-sifter" that sorts out atoms by weight, which will aid investigations of human, animal and plant physiology and in organic chemistry, was described by Dr. Alfred O. Nier, of the University of Minnesota. Speaking before a symposium on isotopes, Dr. Nier told of a small mass spectrograph by which it is readily possible to determine the abundance of isotopes in a given sample. Isotopes are varieties of an element which have the same chemical properties but slightly different atomic weights. For example, in normal carbon 99 out of every 100 atoms have an atomic weight of 12 and one atom has an atomic weight of 13. If sufficient quantities of these heavy carbon atoms can be obtained, they can serve as "tracers" to study how plants transform the atoms of carbon dioxide of the air into their body substance, how organic compounds containing carbon are created, or how the human body utilizes so many of the carbon compounds of which it is composed. The apparatus, a small spectrograph, bombards a gas or vapor of the element (it may be carbon, oxygen, nitrogen or hydrogen) with a stream of electrons. The neutral gas atoms are thus turned into ions with electric charges, which make them susceptible to electric and magnetic fields.

IN other reports in the symposium on isotopes, Dr. Hugh S. Taylor, of Princeton University, showed how light and heavy nitrogen isotopes are being used to study the chemical reactions which produce ammonia synthetically in the presence of isotopes. Dr. Lloyd P. Smith, of Cornell University, told of a new kind of electric ion source which makes available large numbers of ions for use in mass spectrographs. Dr. W. W. Watson, of Yale University, described the construction and operation of a multi-stage thermal diffusion apparatus for the concentration of heavy carbon of mass 13. Other speakers were: Professor Harold C. Urey, of Columbia University; Professor A. J. Dempster, of the University of Chicago; Professor Kenneth Bainbridge, of Harvard University, and Dr. A. Keith Brewer, of the U. S. Bureau of Chemistry and Soils.

A FORECAST of eighty new and yet undiscovered radioactive isotopes of chemical elements was made at a meeting of the American Physical Society by Drs. D. Dickson, P. W. McDaniel and E. J. Konopinski, of Indiana University. The new forecasting method, which should enable nuclear physicists to learn new facts of how atoms are put together, is made by considering the nuclear hearts of atoms which differ in mass by four units (an alpha particle) as analogous. Using the method, a new radioactivity of chromium with a half-life of 2.27 hours was predicted. Experiments proved the existence of this previously unknown isotope.

RADIUM has been produced by transmutation of the common element, bismuth, with the University of Michigan cyclotron, according to a report to the American Phys-

ical Society by Drs. J. M. Cork, J. Halpern and H. Tatel. Deuteron particles, that is, ions of heavy hydrogen of atomic mass 2, were driven at high energy by the cyclotron against the heavy element bismuth. Out of the bombardment came Radium E and Radium F, the latter discovered by Madame Marie Curie and known as polonium. Radium E and Radium F occur in nature, are radioactive and emit alpha particles. The transmutation of bismuth into Radium E appeared to be more easily accomplished than the transmutation into polonium. Four atoms of Radium E were created for every one of the polonium, Radium F.

ATOMS can act like little radio transmitters broadcasting on ultra-short waves between 40 centimeters and 1.5 meters in length, according to the report of Professor I. I. Rabi, of Columbia University, who spoke before the American Physical Society. The atom "broadcasts" are being used to detect the energy difference within the atom for different atomic states. Not only does an atom transmit such waves, but it can absorb them. By applying these short radio waves to atoms passing down his apparatus, specific energies are absorbed which make the atoms go from one atomic state to another; states in which they possess detectable differences in magnetic properties. The transition point is sharp and very exact. It provides knowledge of the spins of the atom nucleus and its associated electrons with an exactness a hundred times greater than ever before. Radio-frequency spectrum analysis also gives indication of the magnetic moments of atoms, for it is known that the nuclei of atoms behave like tiny magnets. Professor Rabi, with Drs. P. Kusch and S. Millman, also described studies on the radio-frequency spectrum of the two varieties of lithium having mass six and seven.

DR. W. W. COBLENTZ, of the National Bureau of Standards in Washington, speaking before the American Astronomical Society, stated that rhodium metal, deposited on glass by evaporation, makes rugged reflecting surfaces for telescope mirrors which withstand chemical corrosion. The rhodium mirror surfaces seem especially desirable for small mirrors used by amateur astronomers in their instruments. The rhodium, evaporated to a vapor in a vacuum and then condensed on the glass surface, avoids the chemical corrosive destruction which occurs on some aluminum-coated mirrors in telescopes. Aluminization, developed and applied in observatories on the West Coast, works well in that climate. But since first introduced a few years ago it has been discovered that elsewhere the mirror surfaces corrode and must be replaced. Dr. Coblenz has found that rhodium applied by evaporation has better reflecting properties than the same metal applied by electrolysis.

"SUPER-SHELL" stars, a class of celestial objects long observed but hitherto neglected by astronomers, were de-

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scribed by Dr. Ernest Cherrington, of the Ohio Wesleyan University. Their distinguishing character is an outer gaseous envelope or atmospheric shell that speeds away from the star itself with explosive velocities up to 70 kilometers (43.5) miles a second. Spectrum photographs of these stars, technically known as the B and Be types, have been almost in the class of nuisances to astronomers, because some of their lines are fuzzy rather than clear and sharp. These faint and fuzzy lines proved, upon analysis, to be indicators of the existence and recessional speeds of the stars' "super shells."

STUDIES of the rate of earth's meteoritic accretion show that the world is gaining a minimum weight of about 100,000 long tons (10^8 grams) yearly from this cause, according to Dr. Fletcher G. Watson, Jr., of the Harvard College Observatory. The meteorite material, most of it microscopic dust, which strikes the earth yearly may amount to as much as 10,000,000 long tons. The accretion amounts to an average of 50 grams per square mile of the earth's surface each year. Although the rate of accretion can not be extrapolated far into the past, at the present rate of increase Dr. Watson estimates that a layer of meteorite dust only one centimeter thick has been deposited, on the average, since the origin of the earth as a separate body in space.

PROFESSOR HARRY N. HOLMES, of Oberlin College, spoke of his work with Ruth E. Corbet and W. B. Geiger, in concentrating crystalline substances from the bone marrow of cows after the high fatty fraction (85 per cent.) has been extracted by saponification. Among these nearly pure crystalline substances, it is believed, is the mother substance which creates the white blood cells, the granulocytes.

DR. WILLY LANGE, of the University of Cincinnati, reported methods of producing fatty acids—from which can be made edible fats and soaps—from paraffin wax, a petroleum product. Large-scale production of what corresponds to a synthetic lard is now operating in Germany.

X-RAYS were used to check up the size of the invisible particles of virus that cause mosaic disease in plants, in experiments reported to the zoologists by Professor John W. Gowen, of the Iowa State College. The size of the virus molecules, or at least of that portion of it necessary for reproduction, was gauged by the wave-length of the x-rays necessary to render them inactive. It worked out as a molecular weight of approximately 15 million, which is in fairly close agreement with the size determined by other means. These virus particles are the largest molecules thus far known; molecules of ordinary organic substances have molecular weights of only a few hundreds, or at most a few thousands.

VIRUSES thrive particularly well on a high nitrogen diet, according to Dr. Ernest L. Spencer, of the Rockefeller Institute for Medical Research, who spoke at the meeting of the American Phytopathological Society. He grew tobacco plants in washed quartz sand, giving some of them a standard nitrogen nutrient solution and others ten times as great a concentration of that element. Measurements of the virus strength in the sap, after suitable periods of

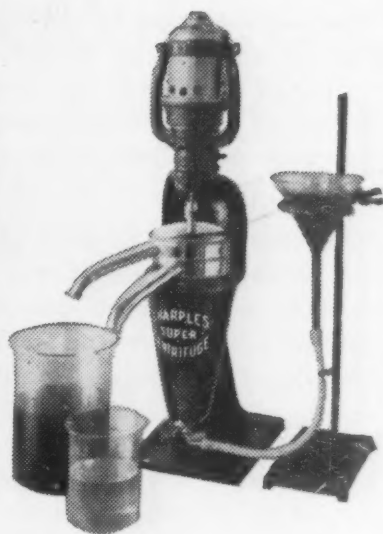
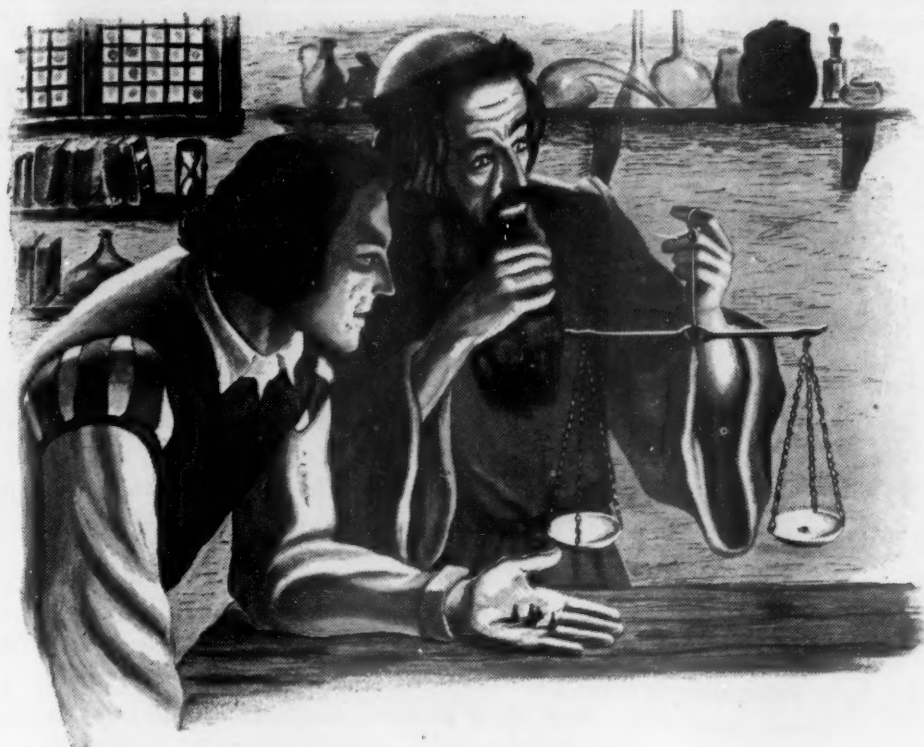
growth, showed much more of the disease-causing entity in the high-nitrogen than in the low-nitrogen plants. Professor Vernon L. Frampton, of Cornell University, told of the discovery that the tobacco mosaic virus belongs to that peculiar group of substances that are liquid as water when stirred or shaken, but "set" like a firm jelly when permitted to stand undisturbed. Such substances are technically known as "thixotropic sols."

BEHAVIOR of tobacco plants after recovering from the virus disease known as curly top was described by Dr. James M. Wallace, of the U. S. Department of Agriculture. The plants were immune to further attacks of the same and closely related viruses, just as a human being who has had smallpox once is immune to that disease. Unlike the human convalescent, however, the recovered plants continue to harbor the virus, and healthy plants can be made sick by transfer-inoculation from them. It was also found that tomato plants could be protected against the virus, to some extent at least, by grafting upon them shoots from recovered tobacco plants.

HONORS were conferred on a tiny insect ally used by man in his ceaseless war against crop and orchard pests, when J. E. Webb, Jr., and C. H. Alden, of the Georgia State Department of Entomology, told how effective has been the aid of a gnat-sized wasplet known as *Trichogramma minutum* in abating the ravages of codling moth and fruit moth in Georgia's famous peach and apple orchards. During the past ten years armies of these midget warriors of more than 300 millions have been raised and turned loose to range the orchards. They lay their microscopic eggs within the eggs of the moths, and the minute but hungry larvae destroy the pests by literally boring from within.

MALARIA mosquitoes in the Tennessee Valley spend the winter in caves like bats, living on the accumulated fat stored in their bodies, according to Drs. E. Harold Hinman and H. S. Hurlbut, of the Tennessee Valley Authority. The specimens they found in their searchings were all adult females that had been mated, so that they were ready to develop and lay their eggs as soon as warm weather came again. "Hibernating females in caves have survived as long as 69 days without food." The temperature ranged from 51.5 to 59 degrees Fahrenheit between December 16 and January 27 in one cave where continuous record was kept. A renewal of reproductive activity occurs early in February and the overwintering females leave the caves at this time.

GREEN leaves, even the thinnest, are exceedingly effective sponges for soaking up sunlight, according to Professor W. E. Loomis, of the Iowa State College, before an audience of chemists. They absorb from 85 to 90 per cent. of the sun's visible radiation, from high violet to well into the red part of the spectrum. But of the ultra-violet, from 7,000 to 30,000 Angstroms wave-length, they absorb almost nothing. So far as visible light is concerned, Professor Loomis stated that leaves are "so selective that only the high percentage of green in sunlight and the sensitivity of the eye to this color makes them appear green." Artificial light, even the cheapest,



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can not compete economically with sunlight as a source of energy for plants, was emphasized by Dr. John M. Arthur, of the Boyce Thompson Institute for Plant Research. "Basement greenhouses" are not practicable if the electric current has to be paid for. "The most practical arrangement at present," he said, "is to use sunlight in a greenhouse while it lasts and to supplement for a period of three to six hours each night with artificial light." The 500-watt lamps used for the purpose supply heat as well as light, and are thermostatically controlled.

BUDS were induced to grow where there had been none before through the use of vaporized growth-promoting substances, in experiments described before the Botanical Society of America by Drs. P. W. Zimmerman and A. E. Hitchcock, of the Boyce Thompson Institute for Plant Research. Cuttings of the Hibiscus species commonly known as Rose of Sharon were used. All the normal buds were cut away, and the cuttings then exposed to the vapors of the growth chemicals. Large numbers of buds were formed in irregular positions—the kind botanists call adventitious buds. As many as 75 of these buds were formed on one six-inch cutting. Most of the buds appeared on the upper portions of the cuttings.

CUTTINGS of woody plants that ordinarily do not readily sprout roots, like apple, pear and plum, can be induced to do so by treatment with one of the growth-promoting substances. Where they do not respond readily to simple soaking in a growth-promoting solution, the process can be speeded up by subjecting them to a vacuum treatment, was reported by N. W. Butterfield, of Purdue University.

TREE rings are not infallible records of the weather in the years when they were formed. It depends partly on the species of the tree. Such would seem to be the inference from records set before the meeting of the Ecological Society of America by Professor Charles J. Lyon, of Dartmouth College. Professor Lyon's studies were made on a number of trees, of six different species, that had grown for years in the near neighborhood of a regularly maintained set of weather-recording instruments. The 1938 hurricane blew them all down, which gave occasion for the study of correlation between their growth rings and past weather records. Closest correlation between spring rainfall and ring growth was shown by white pine, Scotch pine and red oak, but Austrian pine, Norway spruce and European larch showed no consistent agreement with precipitation records of any period. Temperature studies showed almost no correlation whatever when the growing season itself was concerned, but all the coniferous trees gave significant correlations between growth rate and the temperatures in March and April, before the growth starts.

PRODUCTION of a new potato variety, resistant to the deadly blight disease that caused the Great Famine in Ireland in the mid-nineteenth century and that still robs potato growers of their profits all over the world, was announced by Professor Donald Reddick, of Cornell University. The new variety, not yet in commercial produc-

tion, was bred by crossing desirable commercial potato varieties with a wild potato species from tropical America which had been found highly resistant to the destructive blight fungus. Professor Reddick stated that if the potato exhibited holds its record for one year more, it will be released to seed producers for increase. It will be named Desert. It produces a good crop under extremely dry conditions.

ADOPTION of the combine as the predominant wheat harvesting machine in the United States has created some entirely new insect pest problems, according to Professor T. H. Parks, of Ohio State University. Wheat harvested with a combine has a higher moisture content than wheat harvested with older types of machinery, and in the east central states at least, this has resulted in increased losses from weevils attacking the stored grain.

PROGRESS toward the production of a wheat variety able to fight off a number of the crop's most formidable insect and fungus foes was announced by Dr. R. H. Painter, of the U. S. Department of Agriculture. Effort has been made to combine the resistance to Hessian fly found in Marquillo spring wheat with resistance to stem rust, wheat rust and bunt found in various winter wheats, with the goal of producing the best possible new strain of winter wheat. Associated with Dr. Painter in his researches are Elmer T. Jones, C. O. Johnston and John H. Parker.

PRODUCTION of normal bolls of cotton from unpollinated flowers was described by Dr. J. C. Ireland, of the Oklahoma Agricultural and Mechanical College. Using the same growth-promoting substances that have been employed to induce formation of seedless fruits, all the way from holly berries to watermelons, Dr. Ireland treated the pistils of cotton flowers after the stamens had been removed. Both fiber and seed developed normally; the only differences observed were in the embryo plants within the seeds. Dr. F. G. Gustafson, of the University of Michigan, pioneer worker in this "fatherless" fruit production, told how he had grown side-by-side crops of ordinary and unpollinated tomatoes. There was no observable difference between the two products, in either proportion of fruits set by the flowers or in size of the tomatoes when ripe.

AN instrument that might be called an electrical drought-meter was described before an audience of agronomists by Byron Shaw and Dr. L. D. Bayer, of the Ohio State University. It consists of a coil of copper wire wound on a glass tube, which is placed in the soil. Electric current is forced through it, and the resistance measured with a suitable instrumental setup. The drier the soil the greater the resistance. Progress of droughty conditions, from normally moist to extremely dry, can be measured quickly and accurately.

RADIO-PHOSPHORUS, made active so that it gives off detectable particles and radiation in atom-smashing experiments, is a new means of studying how plants absorb fertilizers from the soil, Drs. S. S. Ballard and L. A. Dean, of the University of Hawaii, reported to the American

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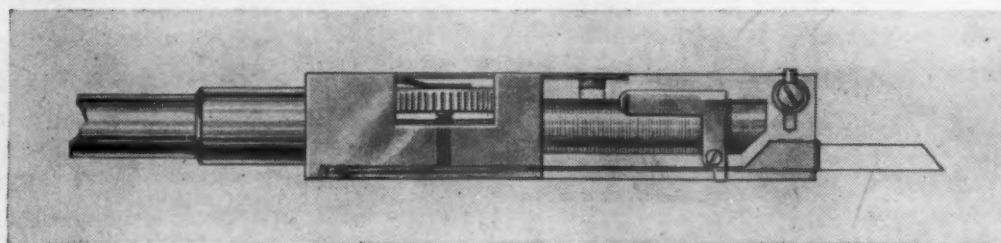
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Physical Society. Radioactive phosphorus is one of the longest lived of the many elements which have now been created artificially by bombardment. Its half life is 14.5 days—which means that its initial strength of radioactivity diminishes to half in that length of time.

THE dizziness, swaying or airsickness that is caused when the semicircular canals of the ears are seriously disturbed can also be produced through training by the simple ringing of a bell, according to Drs. W. Horsley Gantt and H. Loewenbach, of the Johns Hopkins University. A mild electric shock passed through the ears will cause dizziness and loss of balance just as the rapid descent of an airplane might. The adjustment of the nervous system "is so delicate that the animal could be caused to fall in one direction by one bell and in the opposite direction by another bell, depending upon the direction of the passage of the current through the ears.

THAT intelligence is not confined to any single area of the brain's cortex, but is a function of the entire brain, is indicated by experimental findings presented by Professor H. M. Hildreth, of Syracuse University. Indirect methods must ordinarily be used to study the work done by different parts of man's brain, because it is not possible to take out one area after another to measure what functions remain and what are lost. Dr. Hildreth's study was made on those unfortunate persons who through the brain condition known as cerebral arteriosclerosis have had destroyed small areas of tissue throughout the brain. Comparing the achievement of 201 such brain-injured persons on several mental tests with that of an equal number

of "control" subjects matched with them on initial intelligence, Dr. Hildreth found that the deterioration of the brain-injured patients ranged all the way from zero to 90 per cent., according to the difficulty of the particular test. If the ability to pass a given test were dependent upon one particular area in the brain, the scattering of the brain injuries throughout the brain would have resulted in a corresponding scattering deterioration in test performance. Such scatter, Dr. Hildreth did not find.

SURGEONS performing muscle transposition operations to correct motor paralysis might find valuable hints in the motion pictures of reverse-action rats shown by Dr. Roger W. Sperry, of the University of Chicago. When these rats tried to rise upright on their toes, the toes swung up in the air and the animals fell back on their heels. When they lifted their legs in walking, instead of rising with the knee, the foot jerked downward and scraped on the floor. This complete reversal of all movements, both spontaneous and reflex, of the hind feet was due to an operation in which muscles operating the hind foot were transplanted so as to move the foot in reverse. Although the rats lived more than a year after operation and were subjected to training, none of them was able to readjust the reversed coordinations. The results are in accord with the views of some surgeons and physicians that re-education after muscle transposition, when possible, is extremely difficult and tedious. They indicate, Dr. Sperry said, a central nervous system organization of the motor patterns for limb coordination and the relative unplasticity of these basic central nervous processes.

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Biddle Co., James G. 37
Blakiston Company 2
Bureau of Publications, Teachers College, Columbia Univ. 69
Burke & James, Inc. 72
Cambridge Instrument Co., Inc. 25
Cargille, R. P. 14
Carnegie Institution of Washington 66
Carver, Fred S. 36
Central Scientific Company 10
Chicago Apparatus Company 20
Chicago Press, University of 41
Clay-Adams Co., Inc. 15, 26, 27, 47
Coleman & Bell Co. 25
Coleman Electric Co. 29
Comstock Publishing Company 58
Cornell University Press 41
Corning Glass Works 75
Eastern Engineering Company 17
Eastman Kodak Co. 73
Ednal Company, Inc. 26, 27
Edwards Brothers, Inc. 68
Electro-Medical Laboratory, Inc. 25
Eppley Laboratory, Inc. 22
Evans, Adlard & Co., Ltd. 24
Fiedler, Henry George 68
Fish-Schurman Corporation 23

Fisher Scientific Company 16
Frober-Faybor Co. 22
Gaertner Scientific Corp. 31
General Biological Supply House, Inc. 70
Graf-Apsco Co. 20
Green, Henry J. 26
Hartman-Leddin Company 23
Harvard Apparatus Company, Incorporated 45
Hengar Company 16
Hoke, Inc. 47
Holt and Company, Henry 39
International Equipment Co. 11
Kern Company 27
Kewaunee Mfg. Co. 18
LaMotte Chemical Products Co. 26
Lea & Febiger 52
Linde Air Products Company 72
Linguaphone Institute 26
Longmans, Green & Co. 69
Loring, J. Alden 27
McGraw-Hill Book Co., Inc. 48, 49
Macmillan Company 53, 54, 55, 56, 57
Matheson Company 26
Menasha Products Co. 21
Midwest Metal Specialties Co. 27
Mosby Company, C. V. 59
National Technical Laboratories 71
Nelson, George F. 19
New York Scientific Supply Co. 23
Nordeman Publishing Co., Inc. 66, 67
Offner Electronics 47
Paragon C. & C. Co. 34
Perfektum Products Co. 28
Phipps & Bird, Inc. 74
Polaroid Corporation 72
Polychrome Co. 15

Precision Scientific Co. 33
Purina Mills 70
Reinhold Publishing Corporation 50, 51
Rosenberg, L. 26
Ross, Harry 26
Ryerson Press 68
Ryker, Inc., Harrison C. 27
Saunders Company, W. B. 1, 3
Schleicher and Schüll Co., Carl 30
Science Press 69
Science Press Printing Co. 12, 13
Sharples Corporation 43
Sorvall, Ivan 21
Spencer Lens Co. 32
Spindler & Sautpe, Inc. 25
Stacey, Inc., J. W. 5
Standard Scientific Supply Corp. 74
Stanford University Press 69
Stoelting Co., C. H. 14
Stokes Machine Co., F. J. 47
Stylograph Corporation 24
Synthetical Laboratories 27
Thomas Company, Arthur H. 7
Translation & Research Bureau 69
Triplett Electrical Instrument Co. 71
Troemner, Henry 24
Ward, Inc., Charles H., Anatomical Laboratory of 23
Ward's Natural Science Estab., Inc. 73
Warren-Knight Co. 66, 72
Welch Scientific Company, W. M. 17
Wiley & Sons, Inc., John 60, 61, 62, 63, 64, 65
Will Corporation 6
Wilmot Castle Company 19
Winston Company, John C. 5
Zeiss, Inc., Carl 76

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SCIENCE NEWS

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ATOMIC ENERGY

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THE long-sought "chain" reaction in uranium fission, which one uranium atom splitting sets off the fission of another, and so on with each releasing atomic energy in large amounts, is reported by four French scientific men. If science is ever to create a source of atomic power by the liberation of atomic energy in uranium splitting with low-energy neutral particles (neutrons), then chain reactions will be needed to make the fission self-perpetuating. Ever since the first reports of uranium's splitting, a little over a year ago, investigators have searched in vain for the crucial chain reaction. It has remained for Dr. L. von Halban, Jr., Professor F. Joliot, Dr. L. Kowarski and Professor E. Perrin, of Paris, to find the chain effect. They report that the chain effect is convergent, gradually weakening and coming to an end. This result, at first quite discouraging for those who have envisioned atomic power, is only for the particular geometry of the experiment they have performed. Whether it would also be true for other experimental arrangements is not known. Perhaps it could be improved.

During the year of feverish research on uranium splitting which has now elapsed, the number of neutrons liberated by each uranium fission (without chain reactions) has been measured in both Europe and America. It comes out that between 2 and 3.5 neutrons, on the average, are liberated per fission. The test of a chain reaction is to compare this number of neutrons (without chain reactions) with the number of neutrons produced by fissions plus chain reactions.

This the French scientists have done, and they find that eight neutrons are liberated per primary uranium fission, whereas previously they had reported only 3.5 neutrons per fission. The difference, they conclude, is the evidence for the long-sought chain reaction and due to secondary and tertiary effects in the chain.

As a basic source of neutrons a mixture of 160 grams of beryllium mixed with one gram of radium was used. They allowed neutrons created by this source to bombard 300 kilograms (661 pounds) of uranium oxide contained in a copper sphere 50 centimeters in diameter. The copper sphere itself was immersed in a tank of water.

To detect the neutrons present they used detectors of dysprosium placed inside the copper sphere and in the surrounding water. The radioactivity produced on these detectors gave them a measure of the number of neutrons present in various parts of the system.

The goal of uranium fission experiments, from the practical standpoint, has been to produce a chain effect, which would liberate atomic energy (175,000,000 electron volts per fission) and yet remain under control. The fact that the new French experiments are convergent, gradually dying out, may mean one of two things. Either the energy liberation by the chain reaction is difficult to achieve and keep going, or that the scientists intentionally used an

experiment which would give a convergent and thus be safe to carry out.

The new results are reported in the French scientific publication, *Journal de Physique et le Radium*.—ROBERT D. POTTER.

NEUTRINO

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DISCOVERY that the neutrino, the most elusive atomic particle, in all probability has no weight whatever when at rest has resulted from the first important experiments made by Dr. E. U. Condon and his associates at Pittsburgh with the Westinghouse 4,000,000-volt atom smasher.

The very existence of the neutrino has been considered doubtful. The new experiments show its reality, and they make probable that it actually weighs nothing, yet does carry away energy when moving rapidly. Paradoxical as it may sound, a very high velocity of a massless particle will give it energy.

The measurements show that any mass that the neutrino may have is certainly less than 7 per cent. of the mass of the electron, the fundamental particle of negative electricity. The neutrino, like its big brother the neutron, has no electrical charge. The determination of the neutrino's lack of mass was made by finding the least energy with which carbon atoms have to be struck by protons in order to knock out neutrons. The result of such a transmutation is to give radioactive nitrogen. By combining the new data with other energies already measured for nitrogen, it is possible to tell that the neutrino has extremely little or no mass.

Associated with Dr. Condon in the experiments were Dr. W. H. Wells, who designed the large generator, and Drs. W. E. Shoupp, R. O. Haxby and W. E. Stephens, who carried out many of the experiments.—WATSON DAVIS.

SUPER-RABBITS

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THE same powerful chemical that has been used in the creation of new and larger fruits and flowers has been tried on rabbit egg cells.

Colchicine, which doubles the number of heredity-bearing chromosomes in plant cells, allowed the production experimentally in glass vessels of rabbit egg cells with double the normal body number of chromosomes. The research conducted by Drs. Gregory Pincus and C. H. Waddington, of the University of Cambridge, is reported in *The Journal of Heredity*.

Cell division in the experiments did not go beyond the very earliest stages of development. For the present at least, therefore, dreams of colchicine-induced races of giant super-rabbits (and, by inference, of giant super-men) must remain only dreams.

Artificial increase in mammalian chromosome numbers has never been accomplished before, and natural occurrence of higher numbers of these heredity-bearing units in the cell's nucleus has been reported only once or twice,

and then not in egg cells but in structures associated with the developing embryo.

Drs. Pineus and Waddington accomplished their results by treating fertilized rabbit egg cells with colchicine, already well known for its chromosome-multiplying effects in plants. They also used alcohol, ether and abnormally high temperatures; but colchicine was most effective.

The doubling of chromosome numbers resulted from the slowing down of the cell division process. The first stages of division, in which the chromosomes split and thereby double their number, went through as usual, but the cells then failed to finish the process, leaving the two sets of chromosomes in the undivided cells. Subsequently a few of these cells did divide, but only at a rate less than normal. In no case did such divisions go beyond the very earliest stages.

The present work was aided by grants from the Josiah Macy, Jr., Foundation and The Milton Fund of Harvard University.

VITAMIN E

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VITAMIN E, known as the fertility vitamin from wheat germ, is being hailed in medical circles in London as a probable cure for hitherto hopeless diseases of muscle weakness and nerve degeneration. It is also seen as a possible means of protecting children against infantile paralysis and adults against one horrible result of syphilitic infection, locomotor ataxia.

Striking results in treating more than a score of human patients suffering from incurable and even fatal muscle weakness and nerve degenerative diseases with vitamin E are reported by Dr. Franklin Bicknell, honorary physician to the Farringdon Dispensary, London, in *The Lancet*.

The vitamin should also be used to protect children against infantile paralysis, at least during epidemics, according to Dr. Bicknell, though his report does not include such use of the treatment. He believes that in children who have a diet rich in this vitamin the nerve and brain cells attacked by infantile paralysis virus will be more resistant.

Lack of vitamin E in the diet, apparently necessary for nerve and muscle health as well as for normal reproduction, may explain why some patients with syphilis later develop locomotor ataxia while others do not. Dr. Bicknell believes that arrest of this painful, disabling condition may be possible with the vitamin treatment. He tried it, without success, in two cases, but the condition was too far advanced in these patients for the negative results to show what the vitamin treatment can do. Locomotor ataxia, he believes, may be the result not of syphilitic infection alone, but also of a deficiency of vitamin E causing a degeneration of nerve tracts already weakened by syphilis.

Muscular dystrophy, amyotrophic lateral sclerosis, peroneal muscular atrophy and amyotonia congenita are the muscle and nerve disorders for which Dr. Bicknell used the wheat germ or vitamin E treatment. Results of treatment in the muscle weakness condition were remarkable, every patient except one, even bed-ridden patients, showing improvement.

These patients, fifteen of them children, are apparently

the first to receive the new vitamin treatment, although the discoverer of the vitamin, Dr. Herbert M. Evans, of the University of California, reported success in vitamin treatment of similar muscular weakness and wasting in animals.

Vitamin E has been called the fertility vitamin because it is necessary for normal reproduction, but Dr. Bicknell suggests that the substance in wheat germ which produced striking improvement in his patients may be something other than the fertility vitamin. For this reason, suggested by animal studies, he used fresh dried whole wheat germ, one-half ounce twice daily, to treat patients, rather than the chemical, alpha tocopherol, which has been identified as the pure form of the anti-sterility vitamin.

"Our diet may in some cases be on the edge of a vitamin E deficiency," according to Dr. Bicknell. He points out that the most important food source of this vitamin, wheat germ, "is to all intents and purposes never eaten because it is removed from the wheat flour in ordinary milling processes. Other foods containing small amounts of the vitamin may lose it in the course of storage and preparation."

THE PRODUCTION OF AGAR

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JAPAN has a world monopoly of one commodity that the average person never sees and seldom hears about, yet which indirectly is of considerable importance to his health and well-being. It is the stuff called agar, a gelatin-like material made from seaweeds.

Agar is indispensable as a culture medium in all bacteriological laboratories, and hence to all hospitals, medical schools and research institutions occupied with problems in foods, dairy products, soils and all other phases of pure and applied microbiology. Indigestible itself, it is the best substance known to hold in readily available form such favorite germ foods as glucose, beef extract, boiled potato and blood. Agar, in tubes, plates and flasks, is the germs' laboratory dining-table.

Agar comes in dried form, as a grayish, light, stringy solid. It will take up many times its volume of water to form a slightly amber, translucent mass that looks exactly like ordinary gelatin dessert. As a matter of fact, sweetened and flavored agar has been used to some extent as dessert material, but the bulk of the importation has continued to go to the laboratories. Department of Commerce figures show that the United States buys between 600,000 and 700,000 pounds of the dried product every year. The price has been as low as 25 cents a pound, but in recent years it hit the dollar-a-pound mark, and at the present moment the price is \$1.50 a pound, and little or no agar is offered. The Japanese say that severe storms around their islands during 1939 have interfered seriously with the seaweed harvest.

If American and world laboratories were completely deprived of Japanese agar they would not be permanently crippled, although admittedly there would be a period of embarrassment and confusion similar to that experienced on a larger scale when the German sources of dyestuffs and drugs were cut off in 1914. The several species of red seaweed from which agar is made grow in many parts

of the world, including the warmer coasts of the United States; and the manufacturing process is well known and not complicated.

The principal reason why the Japanese have been permitted to enjoy a monopoly in agar is that its making, and especially the harvesting of the seaweed, involves a large amount of hand labor, and such labor is cheapest in Japan.

—FRANK THONE.

FURTHER PAPERS READ AT COLUMBUS

DR. ERNEST L. SPENCER, of the Rockefeller Institute at Princeton, N. J., reported that "Plants receiving from 20 to 40 parts per million of sulfanilamide produced new roots from one to three days earlier than similar plants deprived of the chemical." Uncut seedlings, however, were not stimulated, and concentrations of sulfanilamide which stimulated root formation in cut plants poisoned plants with normal root systems. If sulfanilamide is to be used for fighting plant diseases it must be used in very much smaller doses than can be safely used in treating human patients.

THE first results of scientific efforts to learn how the tiny pituitary gland in the head determines what becomes of the fats, sugars and starches, and proteins such as meat eaten by man and other animals were reported by Drs. Oscar Riddle and Tellef Senum, of the Cold Spring Harbor Laboratory of the Carnegie Institution of Washington. Female sex hormones increase the fat in the blood of fowl, both hens and roosters, and of doves and pigeons of all ages and sexes. Male sex hormones do not increase the blood fat in birds of any age or sex, even when given in thirty times the effective quantity of female sex hormone. One of the many pituitary gland hormones, the one which stimulates sex glands, has now been found to cause large increases of blood protein in doves and pigeons. These increases in blood fat accompany egg production. Fat regulation in rabbits and rats was investigated. A pituitary hormone which increases the blood fat of rabbits, however, it wholly inactive in rats, these species apparently being as different in this respect from each other as each is from the pigeon.

SUCCESSFUL results from anti-cold vaccination in more than 3,000 persons were reported by Dr. Leonard J. Piccoli, of the Fordham University College of Pharmacy, New York. Another 3,000, who did not get the vaccine, had about four times as many colds during any experimental year as those who had taken the vaccine. Large-scale trials of the vaccine on hundreds of thousands of employees in industry have been going on for the past three years in addition to Dr. Piccoli's investigations. The vaccine is made to be taken by mouth, thus avoiding the necessity of frequent visits to a physician. It is taken every day, either before breakfast or before retiring at night. It is made, not from the virus which has been identified as the cause of the common cold, but from other germs found in cold patients.

A CHEMICAL weapon against tooth decay that may prove as effective as sulfanilamide is against streptococcus infections was announced by Drs. Benjamin F.

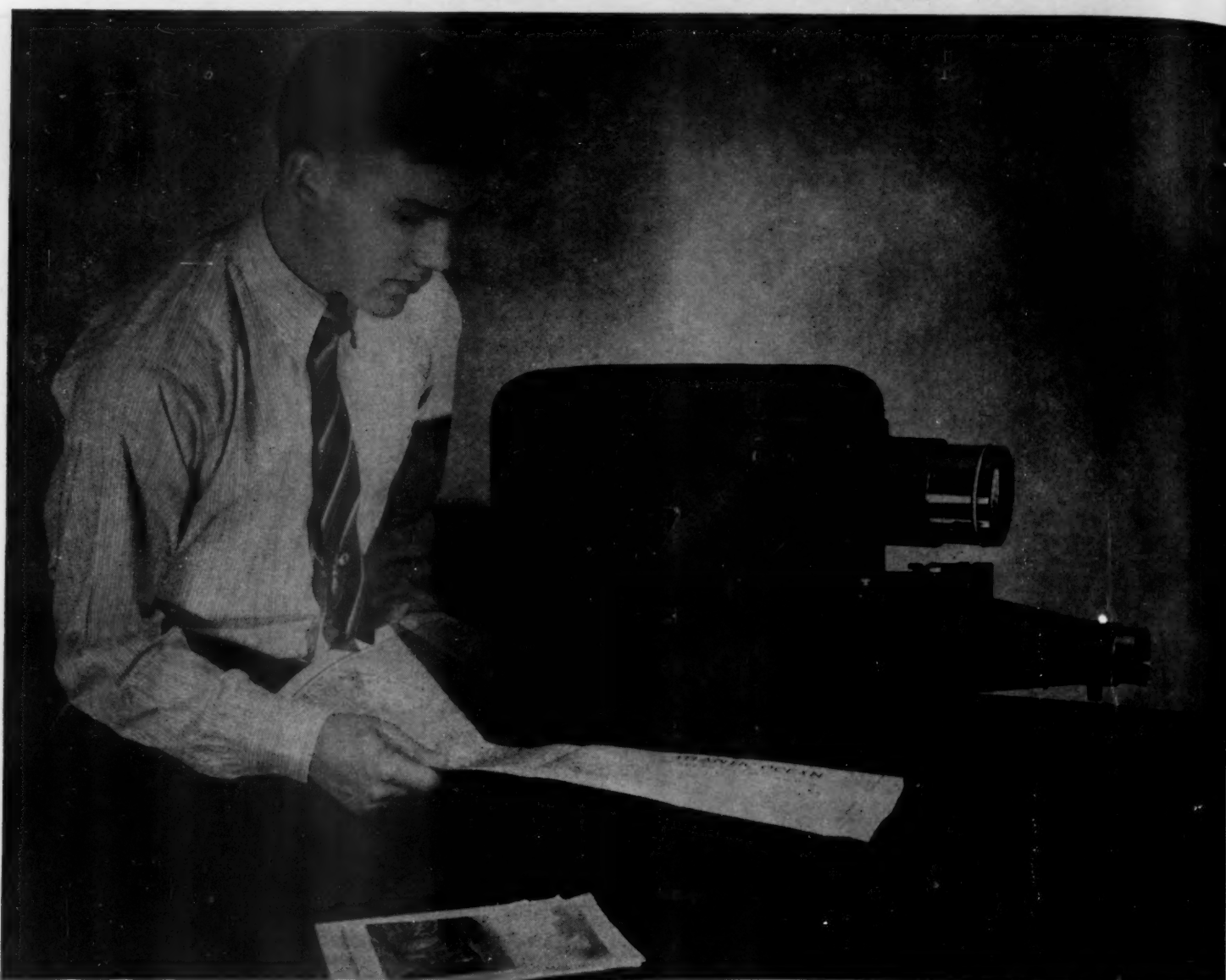
Miller, Sigmund Bradel and John A. Muntz, of the Zoller Memorial Dental Clinic of the University of Chicago. The new anti-caries chemical, called Zephiran, was made by Professor Gerhard Domagk, of the I. G. Farbenindustrie in Germany, who gave sulfanilamide to the world and who was awarded the 1939 Nobel Prize for this achievement. Long-term studies of Zephiran with patients suffering from dental caries are now under way, following the promising results of the laboratory experiments. Zephiran was tried after it was found that two other chemicals, sodium fluoride and iodoacetate, markedly reduced the amount of experimental caries or tooth decay in rats. Search for a better and less poisonous substance than sodium fluoride or iodoacetate to use on human patients led to the trials of Zephiran. This substance is, in chemical terms, alkyl dimethyl benzyl ammonium chloride. It is a powerful germ-killer. In addition, it acts as a cleansing agent, is relatively harmless to mucous membranes such as line the inside of the mouth, and it lowers the surface tension of water.

ITEMS

RECENT German figures on cotton production, given out through the weekly journal, *Die Umschau*, are far too low, U. S. Department of Agriculture data indicate. The German figures showed a world production figure of 3,250,000 bales, in which the USSR participated to the extent of 600,000 bales. The Department of Agriculture figures show a world production, for the year 1938-39, of 27,407,000 bales, with Russian production at 3,800,000 bales. Preliminary estimates for 1939-40 indicate a world production increased to 27,450,000 bales, with Russian production remaining at last year's figure.

A SURVEY of the needs of electrical engineering in the field of transportation was described at the meeting in New York City of the American Institute of Electrical Engineers. J. A. Noertker, of the Cincinnati Street Railway Company, predicted a revolution in urban transportation on the day when an electrical device is invented which will record and collect passengers' fares in proportion to the length of the individual ride. "At present," he said, "the major part of short haul rides are lost because the cost of these rides is, as a rule, out of all proportion to the value to the individual patron."

THE first inch of insulation on a home is as effective as the next 20 inches, according to P. D. Close, of the Insulation Board Institute, Chicago, who spoke at the Cleveland meeting of the American Society of Heating and Ventilating Engineers. "The first 1 inch of insulation," he said, "which will reduce the heat loss through a wall or roof 47.5 per cent., is more effective than the next 3 inches of insulation which reduce the rate of heat loss an additional 33.0 per cent. This next 3 inches of insulation are only 69.5 per cent. as effective as the first 1 inch of insulation in this case. Because of the rapidly diminishing effect of each inch of insulation it would actually require nearly 20 inches of insulation in this case to double the effect of the first inch of insulation, or the first inch of insulation is equal in insulating effect to the next 20 inches."



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SCIENCE NEWS

Science Service, Washington, D. C.

APPARENT CLIMATIC SHIFTS

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APPARENT climatic shifts, such as the current one that has brought a warm winter to the whole Pacific Coast while the entire country east of the Rockies has had to shovel snow, are to be regarded as fluctuations in a longer or shorter cycle rather than as permanent changes. Such is the consensus of opinions independently expressed by members of the U. S. Weather Bureau, the U. S. Coast and Geodetic Survey and the Hydrographic Office of the U. S. Navy. And whatever causes them, a supposed shift in the Japan Current must not be held responsible.

There is a slow, wide swing in air temperatures, not only for the Pacific Coast but for the whole world, that takes about a century to go through, according to J. B. Kincer, of the U. S. Weather Bureau. There was a succession of warm years about a hundred years ago, and we seem to be having another one now. In between, shortly after the middle of the nineteenth century, there was a group of low-temperature years, with cool summers and severe winters. Rainfall cycles (if they can properly be called that) are of considerably shorter duration than this long temperature swing.

Crediting recent warm Pacific Coast winters to a southward shift in direction to the Japan Current was scouted as unfounded guesswork by both H. A. Marmer, of the U. S. Coast and Geodetic Survey, and Commander H. Hartley, of the Hydrographic Office. It is a case of reasoning backward: A shift in the Japan Current could cause a change in climate; the climate on the coast seems to be changing; therefore the Japan Current has shifted. The only trouble with that proposition is that nobody knows whether the famous current has shifted or not. It would be possible to go and find out, but that would take ships, men and money, none of which is available now—or likely to be, with Congress cutting deep even into existing research appropriations.

Until valid evidence to the contrary is brought forth by a well-supported, well-planned, long-continued research program, there is no justification for supposing that the Japan Current has shifted or is shifting. If revolutionary changes had taken place in the ocean bottom recently, with tremendous, world-shaking earthquakes, we might be justified in assuming a shift in the current, but such cataclysmic events have not taken place. So we must let the "Kuro Siwo" flow in peace.

From the Pacific Coast, Professor George E. McEwen, of the Scripps Institution of Oceanography, at La Jolla, Calif., offers support to his scientific colleagues in Washington. "Although it may seem as though the climate is changing," says Professor McEwen, "there is no evidence that the trend will continue in the same direction."—FRANK THONE.

SICKNESS AMONG CHILDREN

THE complacency Americans are apt to feel over the health of the nation's children, based on low child mor-

talities, is dealt a severe blow by figures on child sickness which the U. S. Public Health Service has released.

According to figures compiled by Miss Dorothy F. Holland, one of the federal health service statisticians, children under 10 years of age are sick oftener than any other group in the population except the aged.

The figures refer to frequency of illness lasting from one week or more as found in a survey of 500,000 children in 83 cities of varying sizes in 18 states during one year. The very highest frequency rate for disabling sickness among white children was found at the ages five to nine years. This rate was 305 per 1,000. For Negro children the highest disabling illness rate occurs in the ages under five years.

Acute communicable diseases of childhood and the respiratory diseases caused eight out of ten disabling illnesses among children under fifteen years of age. Among these eight cases, five were acute communicable diseases of childhood and three were cases of acute respiratory diseases. Measles showed a higher frequency than any of the other childhood diseases, though the marked excess of measles shown in the survey reflects the unusually high incidence of measles during the survey year (1935). Mumps, whooping cough and chicken pox also were frequent causes of disabling illness. Among the respiratory diseases, tonsillitis, influenza, colds, pneumonia and bronchitis led in frequency.

Infantile paralysis caused 56 per cent. of all orthopedic impairments due to disease among children under 15 years.

VITAMINS AND NERVOUS BREAKDOWN

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NERVOUS breakdowns which transform strong, courageous men into weak, frightened creatures and drive overtired women into constant, jittery activity are sometimes due to lack of the B vitamins, according to Drs. J. P. Frostig, of the University of California, and T. D. Spies, of the University of Cincinnati and Hillman Hospital, Birmingham, Ala.

Discovery of the nerve-shattering effect of a diet lacking in these vitamins indicates that faulty diet wide-spread in a population may affect not only its health and strength but may break down its morale. It also provides a chemical approach to at least one group of nervous breakdowns.

Drs. Frostig and Spies state in a report to the *American Journal of Medical Sciences* that the nervous symptoms which appear when the B vitamins are lacking in the diet give doctors the first signs by which they may diagnose pellagra. The nervous signs appear in patients who have no other symptoms of pellagra and who might therefore be labeled neurotic or neurasthenic.

Physicians have long known that pellagra affects the nerves. Many pellagra patients in the past ended their days in insane asylums. The nervous symptoms which foretell an impending attack of pellagra, however, and which link vitamin lack with breakdown of morale, have never before been noted as a sign of vitamin deficiency.

Regardless of what type of personality the patients normally have, when they begin to get pellagra, they all develop the same characteristics. They are restless, excitable and easily frightened. Noises make them jump, odors bother them more than usual. They are tired but can not sleep and are too "fidgety" to rest. They feel depressed and constantly expect some harm to befall them or their families. A brawny coal miner who liked to engage in prize fights said: "I'm scared to death. If I see two men fighting with their fists, it seems to me that I will pass out."

Either of three parts of the vitamin originally known as B cures the condition. Chemically, these three B vitamins are known as thiamin, cocarboxylase and nicotinic acid. They are all found in fresh meat, fresh vegetables, eggs, milk and yeast. When the nervous patients were given a dose of one of the three vitamins, they felt better within an hour, and within 24 hours neurological tests showed their nerves were reacting normally to touch, pain and the like.

While nervous symptoms had been seen in patients with pellagra, the exact relation between the B vitamins and nervous breakdown was established in a careful study of 60 pellagra patients, with the support of the Rockefeller Foundation and the William C. Hogg Memorial Fund of the University of Texas.

PITUITARY EXTRACT AND DIABETES

A NEW attack on diabetes, by way of the pituitary gland, has been launched through the researches of Professor J. B. Collip, of McGill University. Professor Collip states that a specially prepared extract of the pituitary, the small but important gland in the head, "has a profound effect upon carbohydrate metabolism."

Carbohydrate metabolism, the utilization by the body of sugars and starches from foods, is the mechanism that goes wrong in diabetes. Failure of the Islands of Langerhans in the pancreas to produce sufficient insulin has been considered the cause of the condition, and insulin in proper dosage keeps diabetics healthy. Other glands besides the pancreas, however, have been shown to play a part in carbohydrate metabolism. In fact, it is known that the glands of internal secretion, such as pancreas, pituitary, thyroid and adrenals, are closely related and influence each other in various ways.

Now that a pituitary gland extract which affects the body's utilization of sugar and starch has been discovered, the next step will be to learn how it achieves this effect. The work is still in an early stage and is purely of academic interest as yet. But it has already raised a number of questions which, when solved, may show the whole problem of carbohydrate metabolism and of diabetes in a clearer light. Among the questions to be answered are whether the pituitary extract achieves its effect on sugar utilization directly, whether it acts through the adrenal glands, whether it acts by stimulating the pancreas to produce more insulin, and whether it reinforces the action of insulin by the process of synergy.

SYNTHETIC GLYCERINE

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SYNTHETIC glycerine, a product long sought in vain by

chemical industry, is now available from petroleum. Recent technical reports to the American Chemical Society by Dr. Evan C. Williams, Dr. H. P. A. Groll and G. Hearne, of the Shell Development Company, at Emeryville, Calif., show how unlimited quantities of the compound can be made from cracked gasoline.

Glycerol, as the chemist prefers to call glycerine to show its family relation to alcohol, has ever been the victim of fickle market conditions, since it is a by-product of rather fixed quantity from the soap industry. A change in demand, as occasioned by war conditions or peace treaty, does not affect supply and thus prices skyrocket and dive most inconveniently. Figures from 9 to 70 cents per pound have been quoted since the World War. During the one year, 1938, the price dropped nearly 60 per cent.

Although glycerol is a simple organic compound, its molecular structure, with one atom of oxygen attached to each carbon atom, has baffled the synthetic manufacturer who must use processes of low cost. By allowing chlorine to react upon propylene, a gaseous component of cracked petroleum, it has been possible to produce at low cost the substance allyl chloride. From allyl chloride the compound trichloropropane is then readily prepared. The molecule of trichloropropane is similar in structural design to that of glycerol, and the product is readily convertible into glycerol with the aid of cheap alkali.

The new synthetic glycerol has been tested in gross quantities in the stomach, with effects even less unpleasant than those from the pharmaceutical grade of natural glycerol. Being identical in composition, the preparation needs attention only to purity standards, and this question is easily solved.

It is suspected that much more of interest is in view than a mere stabilization of price and strategic war supply for time of siege. By combination of glycerol with acids, a remarkable array of valuable oils is possible. These compounds are analogous chemically to olive, cotton and linseed oils, but without the narrow restrictions in quality and quantity imposed by nature in plant growth.

From petroleum it is likely that entirely new acids, perhaps those with molecules in bunch-like form instead of the chain form normally followed by plants and animals, may be available for this field of research. From such syntheses it is possible that lubricants superior to castor oil, and paint vehicles ahead of linseed oil, might be discovered. The castor and linseed products are glycerol-acid compounds of the type in question. Furthermore, the resin industry is interested in the prospect of cheap glycerol, which with complex acids forms very complex derivatives suitable for use as plastic resins.

THE SOCIAL SECURITY ACT

(Copyright, 1940, by Science Service)

THE number of retired men and women who receive their first old-age Social Security checks during 1940 is only a small fraction of those who will become eligible for such benefits in the next 45 years. Even if the Act is not broadened in future, probably more than 7,000,000 would be included in the plan as compared with something like 300,000 this year.

Those who earned wage credits in 1937, the first year of the Social Security Act, are relatively few in the older age

groups. If you should draw a bar diagram in which the length of each bar represents the percentage of men with 1937 wage credits at a certain age level, you would find it looking like the under side of a stairway with the longest bars at the ages of 20 to 34 and with steadily decreasing steps from there down to the 60 to 64 group where only 27 per cent. earned credits. A much smaller percentage of women in the older age groups earned wage credits in that year.

This means that although 1940 will see relatively few persons with wage credits at the retirement age, by forty or forty-five years from now the large group of present young men workers representing from 61 per cent. to nearly 64 per cent. of the total population at those ages will have reached sixty-five years, the time to apply for old-age benefits. However, all who had 1937 wage credits will not necessarily be eligible for monthly benefits.

No one can estimate exactly just how many will be at the old-age benefit age in 1985, because the actuarial tables on which such predictions are based vary widely. The insurance statisticians who figure such tables like to lean over backwards so as to avoid expensive errors in estimates. Thus, those figuring on survivors to collect annuities conservatively figure on a much smaller future death rate than do those who estimate what must be paid in death benefits.

Robert J. Myers, actuarial mathematician for the Social Security Board, recommends in the "Social Security Bulletin" that the conservative person in calculating the costs of such a benefit plan use more than one estimate and plan for costs in a rather wide range. Using the survival table known to statisticians as the "U. S. White Table," based on experience among the total U. S. population during 1920-29, he estimates that 7,338,000 of those earning 1937 wage credits will be 65 or over in 1985. Using the "Standard Annuity Tables," the number is estimated at 10,417,000. With either table as the basis of calculation, the million mark will be passed by 1950.—MARJORIE VAN DE WATER.

ITEMS

THE reopening on May 11 of the popular medical and public health exhibits of the New York World's Fair has been announced by Dr. Louis I. Dublin, acting chairman of the American Museum of Health. In a letter to Dr. Dublin, Surgeon-General Thomas Parran, U. S. Public Health Service, stated that the exhibit last year "gave to several million people from the United States, Canada and elsewhere valuable, life-saving knowledge." The federal health service cooperated with the American Museum of Health in a visitor reaction study which showed that visitors to the medical and health exhibits gained from them vitally useful knowledge of health and medical matters. New exhibits, to be announced later, will be added to the Carrel-Lindbergh "heart," the Transparent Man and other dramatic exhibits which last year vied in popularity with such industrial features as the General Motors Futurama and the American Telephone and Telegraph Company's Voder. The medical and public health exhibits last year drew a record-breaking attendance of 7,500,000 visitors, approximately one out of every three World's Fair visitors, and more by 2,000,000 than the total

attendance of any previous public exhibit of medicine and public health anywhere in the world.

A 2,000,000-VOLT artificial "lightning" machine has been constructed at the Ryan High Voltage Laboratory at Stanford University. By sending its crashing shocks into power lines, insulators and other electrical equipment it is expected to use the "tame" lightning to test equipment and learn more about how to protect transmission lines and accessory electrical apparatus from shocks to natural lightning. Financed by electrical companies on the west coast, the new apparatus is the most modern of its kind, although its peak voltage of 2,000,000 is less than that of apparatus previously developed. In tests at Pittsfield, Mass., 10,000,000 volts have been used.

THE exact amounts of calcium needed for normal, strong teeth and bones and the speed with which calcium eaten in food travels through the body are being determined in experiments with tagged atoms of radioactive calcium at the University of California. Results of this first biological study with radioactive calcium have been announced. No clinical experiments, however, have as yet been attempted. The radioactive calcium of sufficient long life for this type of experiment was discovered with the University of California's famous atom-smashing cyclotron by the late Dr. Harold Walke, of the University of Liverpool, who was accidentally electrocuted in his laboratory when he fell on an exposed wire.

A CHEMICAL compound that may prove as good a remedy against infectious diseases as sulfanilamide, with less toxic effects, is announced by the U. S. Public Health Service. The compound, prepared by Drs. Hugo Bauer and Sanford M. Rosenthal, of the National Institute of Health, contains phosphorus instead of sulfur and is different in other ways from sulfanilamide. Three such compounds have been prepared, of which one, bis (4-dimethylamino-phenyl) phosphinous acid, checked streptococcus infections in mice and had a low toxicity. No human trials of these chemicals have been made yet, nor will they be, Dr. Rosenthal said, before more extensive laboratory investigations. The object of the research, in which compounds with arsenic substituting for the sulfur of sulfanilamide were also made, is to find chemicals which either are better than sulfanilamide or are effective against germ infection which sulfanilamide does not check.

FOSSIL leaf prints that look like poplar leaves, but are not, which have been riddles to scientists for many years, have been traced to a family of trees now known only in Japan and China, by Dr. Roland W. Brown, of the U. S. Geological Survey and the Smithsonian Institution. The fossils have been found in rocks all the way from Greenland to Tennessee, and have been assigned to poplar, fig and other plant families; but Dr. Brown was not satisfied. For many years he carried on patient scientific investigation, and finally was able to prove their true relationship by means of their association with fossil pods and seeds of the type of tree now known by its Japanese name, katsura. In Washington, there is now one imported katsura tree, a young specimen growing on the grounds of the National Academy of Sciences. The last native katsura relatives in this country died 70 or 80 million years ago, while dinosaurs still roamed the earth.

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Ready February 1940

Approx. 477 pages; 229 illus.; 6 by 9; Probable price, \$5.00

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SCIENCE NEWS

Science Service, Washington, D. C.

THE MIGRATION OF ANIMAL GROUPS

How animal families became emigrants in past geologic ages, and the effects which their migrations had on their fortunes, were discussed recently by Dr. George Gaylord Simpson, of the American Museum of Natural History, at a meeting of the Washington Academy of Sciences.

Animal families tend to follow one pattern, in their rise, expansion and decline. A family will come into existence in a rather limited ancestral territory. It will increase greatly in abundance, and at the same time expand rapidly to its maximum area. Then come simultaneously a thinning out in numbers and a contraction in the territory occupied, and finally extinction.

When the decline-and-contraction phase sets in, the retreat is not necessarily to the old homeland. Many an animal family has died out thousands of miles away from the place where it started. Sometimes, too, there will be surviving "islands" of a group, widely separated and with the once-existing connections wiped out. Such, for example, are the African and Indian elephants, and the American and European species of bison.

Land bridges, that may connect continents or islands for a time, permitting animal migrations, are not always broad, easy highways over which interchanges of animal populations are rapid and complete. Relatively few land bridges are such easy "corridors."

The more usual kind of land bridge is what Dr. Simpson called a "filter-bridge," which permits travel only under conditions that may be just possible for some of the migrants and quite impossible for others. Such a "filter-bridge" exists between North and South America, at the Isthmus of Panama. South American monkeys are on the Panama land bridge, but they have never crossed it into even the tropical parts of North America. They soon encounter forests of a type not at all hospitable to monkey life, and can go no farther. Similarly, bison from North America have never been able to traverse the Panama land bridge or any of its geological predecessors into South America. They are animals of the open grasslands, and to them a tropical forest is as great a barrier as the open sea itself.

Dr. Simpson pointed out that ability on the part of an animal type to migrate and expand rapidly in new territory does not necessarily mean that it is going to be a success. The great ground sloths and giant armadillos, that rapidly expanded from South into North America in relatively recent geologic times, died out very soon after their period of greatest expansion. Ability to expand and ability to survive have no necessary connection at all.

THE PRODUCTION OF OIL WELLS

(Copyright, 1940, by Science Service)

A NOVEL method of drilling and pumping oil wells—pumping the oil so that it goes down instead of up through oil-bearing sands—was described by Professor F. B. Plummer, of the University of Texas, and H. K. Livingston, of the University of Chicago, at the recent

meeting of the American Institute of Mining and Metallurgical Engineers in New York City. The new method studied and worked out in the laboratory, will perhaps solve a difficulty confronting oil men everywhere; what to do with a well of the "marginal" variety that is pumping about 90 per cent. water and only 10 per cent. oil. The new results may be regarded as laboratory signposts pointing to a more efficient drilling and pumping of the nation's petroleum resources.

Making experimental counterparts of oil fields and pumps, it was found:

1. That ordinary upward pumping creates a "cone" of water about the well which often shuts out the flow of oil in the oil-bearing sands.

2. That detergent chemicals—in some cases merely soap flakes—can reduce the surface tension forces on the water so that it is not pulled through the sands so easily by capillary attraction.

3. That downward pumping of the well—so that the flow of oil in oil-bearing strata was downward instead of up—tends to prevent the formation of the water cone which previously excluded the oil.

In one test, where the experimental oil and water mixture was passed through limestone, it was found that 5 per cent. oil and 95 per cent. water was coming through. Then a very small dose of soap flakes of a popular variety was added to the oil-water mixture. This changed the ability of the limestone to transmit water so much that quickly the laboratory "well" was pumping 68 per cent. oil and only 32 per cent. water.

Soap flakes would not work for all waters encountered in typical oil well fields, but where it failed other chemicals such as Aerosol OT, Igepon AP/1 and phenol worked successfully.

ADVANCE IN TELEVISION

(Copyright, 1940, by Science Service)

TELEVISION of the future, giving 30 per cent. more detail than present 441-line television pictures, was demonstrated in a tour of the homes of Philco Radio and Television Corporation engineers.

According to William H. Grimditch, vice-president in charge of Philco's engineering laboratories, the new television advance uses 605-line screens to secure details on the televised images. The new research progress takes much of the fuzziness out of the pictures and is a step on the way to the display of television to large audiences on large-sized screens. "A comparison which may give an idea of this improvement is the difference between the coarse screen reproduction of a picture on ordinary newsprint and the fine screen reproduction of the same picture on slick paper. The coarse screen newspaper reproduction may be likened to the 441-line television picture in use at present, while the fine screen reproduction on slick paper is comparable to what one sees on a television screen with a 605-line picture."

A new type of small, vertical loop antenna built into

television receivers was also demonstrated. This loop allows real "plug-in" receivers in contrast to the specially built dipole antennas which now must be mounted on roof tops. To make feasible the use of these new loop antennas, however, it would be necessary to transmit television signals with their waves polarized vertically instead of in a horizontal plane as is done at present. The built-in loop antenna is especially recommended to help cut out interference from the ultra-short wave diathermy machines which are now coming into use in physicians' offices and in hospitals. Interference from these medical devices—which act as short-wave transmitters—is one of television's major problems. By easily rotating the new built-in loop many cases of diathermy interference can be minimized. There is nothing much one can do, however, if the diathermy machine happens to lie in the same line as the television transmitter.

The problem of presenting television pictures to a large audience, in a fashion following motion picture practice, is to improve the viewing distance and viewing conditions. With 441-line screens and large-sized pictures one can not get too near or else the picture takes on a fuzziness and "graininess" that is objectionable. Anything that can be done to increase the fineness of the television picture and improve detail permits the audience to be placed nearer to the screen and still see a picture without the coarseness and graininess.—ROBERT D. POTTER.

MANAGEMENT AND RESEARCH IN INDUSTRY

(Copyright, 1940, by Science Service)

KEY jobs in the upper ranks of industry are awaiting an oncoming generation of young men now receiving their scientific or technical training in American universities. They are needed because industry is increasingly tapping the frontiers of scientific knowledge by research.

If any one message came out of the meeting of the American section of the Society of Chemical Industry on February 16 it was that, right now, industry needs men who can serve as the liaison link between the presidents of industrial companies and the research men those industries employ.

Increasingly, said Dr. E. C. Williams, director of research and vice-president of the Shell Development Company, technically-trained men are finding their way on to the directorate boards of companies. But until the day when every industry follows this practice there must be better links between management and research.

Misunderstanding may arise out of the backgrounds of research and executive leaders, Dr. Williams continued. The executives—handling finance, commercial and organizational affairs—are influenced greatly in their decision by human relationships. The executive technique is accomplished through persuasion, compromise, leadership and personal determinations. The training of research men, in contrast, has no place for personality or persuasion because a scientist deals with coldly material things like the properties of matter and forces of nature which are outside the realm of human things. To bridge

the gap between these two poles is the need of every industry. The top executive needs to be aware that he, himself, by his own decisions, can cloud true issues.

A statement or a wish by the president of a corporation, Dr. Williams declared, may acquire such importance that its mere expression may make that belief a fact. Dr. Williams pointed out that "If the president of the U. S. Steel said he thought steel was likely to go up, it very likely would go up. What might not have been a reasonable happening before he spoke actually becomes a fact because he spoke. If any one else had said so there would have been no such effect. Thus the mind can create actuality."

Every company needs, too, some one who can present to the executive the true picture of scientific training which makes research men sometimes argue over precise definitions of established facts, or over technical matters on which differences of opinions are permissible. The executive often thinks these arguments indicate serious rifts between his advisers or a troublesome disposition (dread of all business men), whereas the scientists are really only enjoying themselves because no one's personal prestige is at stake.

Dr. Williams continued: "The research director is a kind of crystal gazer to industry, without the hocus-pocus. The picture in the crystal for a year ahead is rather clear; further into the future it may be blurred, yet formed in its main outlines; even up to five or ten years ahead dim forms can be seen through the fog. These are not unsubstantial dreams; they are definite indications of future movements in industry."—ROBERT D. POTTER.

THE DROUGHT

DROUGHT still grips the greater part of the United States, despite January's big snow that wiped out people's recollection of an abnormally dry and warm December, following a phenomenal lack of rainfall reaching back to August of last year.

Statisticians of the U. S. Weather Bureau have been at work compiling precipitation records. They have found only six states with normal or above-normal rainfall for the last half of 1939; and the record is little improved thus far in 1940.

Of the six states, two (Florida and Alabama) had exactly 100 per cent. normal rainfall from August to December, 1939. During the first month of 1940 their rainfall was nearly up to normal, and they were joined in the "normalcy" column by Georgia, which took a 106 per cent. dousing in January, partly offsetting its 83 per cent. record of the last months of 1939. During the first two weeks of February, rains in the Southeast have continued, until now the fields over a large part of the region are too wet for plowing.

The remaining states in the normal-and-better precipitation list for August-December, 1939, are in the Southwest: Utah, Arizona, Nevada and California. However, for all except California (and for part of that state as well) 100 per cent.-plus precipitations mean less than they do elsewhere, because of the large desert and semi-arid areas included within their boundaries.

Since the first of the year, heavy rains and snows have continued in the Far Southwest, approaching twice

the normal rate for all except Arizona, where a drop to 60 per cent. was experienced in January. The heavy precipitation area has spread northward to Idaho and eastward to Nebraska and Kansas, where extra water counts importantly in the grazing and winter wheat areas, badly depleted by the autumn drought of last year. The soil moisture deficit in the Plains states is still far from being balanced.

Precipitation records from the Midwest and Northeast continue to show drought conditions, ranging from about half to three quarters normal for the last six months of 1939 and for 1940 to date. Michigan alone seems to have escaped the curse, with 95 per cent. normal for August–December, 1939, and 122 per cent. in January, 1940.

There is a dry belt, relatively speaking, in the Middle South. Arkansas seems to be the hardest up, with 59 per cent. of normal rainfall for the closing six months of 1939 and only 35 per cent. in January, 1940. Somewhat similar conditions obtain also in Tennessee and Kentucky, except that these states were drier last season and seem to be a little more favored with moisture thus far this year.

THE NEW UNITED STATES POSTAGE STAMPS

UPON new U. S. postage stamps there are appearing this year portraits of 35 intellectual leaders of America, five artists, five authors, five composers, five educators, five poets, five inventors and five scientists.

This recognition upon our stamps of other than military and political leaders will meet, in principle, with general approval. And it will not cost the government money because collectors buy stamps by the thousands that are never used for postage.

Whether the right five in each group have been picked is another question. Most lack of agreement with the Post Office Department's selection is likely to be expressed in connection with the selection of scientists: Luther Burbank, Dr. Crawford W. Long, Dr. Walter Reed, John James Audubon and Jane Addams.

Dr. Reed, who demonstrated the transmission of yellow fever by the mosquito, will meet with universal approval in science circles. Audubon, the pioneer American naturalist and gifted portrait painter of birds, will too win approval. Jane Addams, great humanitarian, is hardly considered a scientist in the strict sense. For great welfare workers, why not a special series to do them honor?

The selection of Dr. Long revives the controversy as to who deserves the credit for ether anesthesia, this Georgia village doctor or William T. G. Morton, Boston dentist. Long was chronologically first, but the use of ether for operations spread from the Boston focus. Why not honor both with stamps?

Most controversy will be caused by the face of Burbank upon a stamp. He is rated a great gardener rather than a great botanist.

Scientists by the dozen have equal reason for being honored on our stamps. Joseph Henry, who ranks with Faraday as the father of the electrical industry; Benjamin Rush, early physician of Philadelphia; Josiah Willard Gibbs, founder of thermodynamics; Simon New-

comb, the astronomer; Asa Gray, the botanist; Benjamin Silliman, early Yale chemist; Joseph Leidy, E. D. Cope and Othniel Charles Marsh, great explorers of ancient and living animals; Dr. William H. Welch, great pioneer in medicine.

Two great scientists and a great agriculturalist, already honored with stamps, may be claimed by science: Benjamin Franklin, Thomas Jefferson and George Washington.—WATSON DAVIS.

ITEMS

PROTHROMBIN, a vital element in the mechanism which brings about clotting of blood that is shed, disappears from the blood when it passes through the lungs, Drs. William DeW. Andrus, Jere W. Lord, Jr., and Joseph T. Kauer have discovered in experiments at the New York Hospital and the Cornell University Medical College. Why this occurs has not yet been determined, but the New York investigators in an article printed in *SCIENCE* suggest, on the basis of earlier research by Drs. W. H. Howell and D. D. Donahue, that the disappearance of prothrombin may be caused by the action of the blood platelets which are apparently formed in the lung and which, by releasing thromboplastin, change prothrombin to thrombin. Thrombin is a ferment which acts on fibrinogen to form fibrin, the essential portion of the blood clot.

BRITISH shipbuilders, working under the new Ministry of Shipping, are planning large-scale construction of ocean-going vessels built of reinforced concrete instead of steel. Reinforced concrete ships, tried successfully during the last war in Scandinavia, France, Italy and on a large scale in the United States, require less steel and skilled labor for their construction than do ordinary vessels. Tried before in Britain only on an extremely limited experimental basis, concrete ship construction demands only a slipway and ordinary building contractor's equipment. Maintenance of the finished ship is also reduced, as cleaning and painting are unnecessary. Though entirely seaworthy, the concrete craft are considerably heavier than steel vessels of the same size and are slower. They are often launched upside down because construction is easier and cheaper, if the keel is uppermost. The hull is righted by flooding compartments on one side.

RADIOACTIVE phosphorus is being used in a study of the chemical activity of the brain. Different parts of the brain not only have different functions in mental activity, they differ also in the way they handle the chemicals that are necessary to all life. Giving animals phosphorus made radioactive by bombardment in the cyclotron, Dr. I. L. Chaikoff, of the University of California, with B. A. Fries and G. W. Changus, traced this detector chemical in the forebrain, cerebellum, medulla and spinal cord. Soon after birth, they found, the chemical activity involving phosphorus in these parts of the brain and nervous system declined at a similar rate. Later, however, the rate of drop was no longer uniform, but was much more precipitous in the spinal column. It is hoped that this study may lead to the discovery of the interrelationships between the chemical and mental functioning of the brain.

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SCIENCE NEWS

(Science Service, Washington, D. C.)

RECORD HIGH PRESSURES

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NEW world's record high pressures, as much as 3,500,000 pounds per square inch, have been achieved by Dr. P. W. Bridgman in Harvard's physics laboratories through use of nests of high pressure vessels in which inside apparatus receives outside support at critical parts.

A piece of tool alloy, Carboloy, composed of tungsten carbide and cobalt, was subjected to a compressive stress of between 200,000 kilograms per square centimeter (2,800,000 pounds per square inch) and 250,000 kg./sq. cm. (3,500,000 lb./sq. in.) without fracture. Carboloy's crushing strength under normal conditions is not more than 70,000 kg./sq. cm. (1,000,000 lb./sq. in.). The confining pressure that made possible these new high pressures was about 25,000 kg./sq. cm. (350,000 lb./sq. in.).

Dr. Bridgman, in reporting his results to *The Physical Review*, also made known that under such extreme pressures, carbon in the form of a thin plate of crystal graphite is not converted to diamond at room temperature. Both graphite and diamond are carbon. There had been hope that pressure alone might cause the formation of diamond out of the other form of carbon. "It is probable that no pressure, however high, will accomplish the conversion at room temperature," Dr. Bridgman now concludes. Doubling of the pressure apparatus, as practised by Dr. Bridgman, makes it possible to reach pressure considerably more than double because of the increase in intrinsic strength under hydrostatic pressure.

A striking effect of the extreme high pressures on Carboloy was that, although under normal conditions it is highly brittle and breaks with practically no plastic deformation, under the confining pressures used by Dr. Bridgman the piston of this tough material was plastically and permanently shortened by 5.5 per cent. with no perceptible cracks.

SOME PAPERS READ AT THE NEW YORK MEETING OF THE AMERICAN PHYSICAL SOCIETY

A NEW suggestion that the sun's corona is formed by the motion of matter driven out under the action of the sun's intense light was presented at the New York meeting of the American Physical Society by Professor Felix Ehrenhaft, now of New York City and formerly head of the department of physics at the University of Vienna. Professor Ehrenhaft reported experiments in which material particles were allowed to fall slowly in a magnetic field. When bright light was shone on these particles they moved quickly sideways along the magnetic lines of force in the field. When the direction of the magnetic field was reversed, the motion was reversed. When either the light or the magnetic field was shut off the sideward motion stopped and only the pure motion of fall remained. These experiments, Professor Ehrenhaft said, explain the sun's corona by indicating that particles in the sun move outward along magnetic lines of force due to the action of

the sun's own light. He pointed out that the late Dr. George Ellery Hale, distinguished astronomer of Mount Wilson Observatory, long ago called attention, without explanation, to the similarity between the solar corona and the lines of force of a magnetized sphere.

PROFESSOR EHRENHAFTH also discussed measurements which cast doubt on the long-held postulate of physics that the charge on the electron is the smallest unit in which electricity occurs. Still a third research announcement by Professor Ehrenhaft was that light can, under certain conditions, exert an attractive force on matter in contrast to its commonly-recognized repulsive effect. This effect may have applications in explaining phototropism, that property of plants to lean and turn so that they face the light.

A NEW means of measuring accurately the voltage generated by the new, giant electrostatic atom smashers was described by Drs. W. H. Wells, R. O. Haxby, W. E. Shoupp and W. E. Stephens, of the Westinghouse Electric and Manufacturing Company. The new calibration point is at 2,010,000 electron-volts of energy at which beryllium begins to give off neutrons when it is bombarded with protons (cores of hydrogen atoms). The work extends and makes more accurate previous studies at the University of Rochester. Similar success with proton bombardment of boron carbide, lithium and carbon atoms was also reported by Dr. Wells and his colleagues. "All of these reactions, or thresholds, occur at a very sharp and definite voltage," Dr. Wells explained, "and will consequently serve as a good interlaboratory voltage standardization table." The new results fit in with many other observations made at the Carnegie Institution of Washington and at the University of Wisconsin on the gamma rays emitted from lithium and from fluorine. These findings, too, serve as valuable calibration points for the giant electrostatic generators with which scientists smash atoms in these laboratories.

A NEW check on the enormous amount of atomic energy released when uranium atoms are split by neutrons was described at the closing meeting by M. H. Kanner and H. H. Barschall, of Princeton University. As heavy uranium splits it gives off two fragments. The energy of these splitter products has been measured at Princeton and found to be equivalent to 159,000,000 units of atomic energy. Units of atomic energy are expressed in electron-volts. This value is in good agreement with measurements made by Dr. Malcolm Henderson, also of Princeton, on the heating effect of uranium's fission. Dr. Henderson has previously reported 175,000,000 energy units liberated. Other reports to the physicists' meeting concerned uranium fission; one of the most intriguing of all problems in science to-day because it offers at least the remote possibility that some day and somehow it may be possible to utilize the vast amount of atomic energy thus liberated in some practical way. Dr. Herbert L. Anderson, of Columbia University, described measurements on the resonance

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capture of neutrons by uranium. This is an important matter because the ease with which a neutron can be captured by a uranium atom determines how easily a splitting of uranium atoms can be secured. His studies show that neutrons having only 5 electron-volts energy are involved in liberating energies which, for each uranium fission, amount to over 150,000,000 electron-volts.

THREE new forms of artificially radioactive indium, created by bombarding the rare metal with high-voltage x-rays, have been manufactured by a research group at the Massachusetts Institute of Technology. The discovery, reported to the American Physical Society, confirmed the findings of Notre Dame physicists that high-voltage x-rays would produce radioactivity. The artificially activated indium made in that experiment had a half-life of four hours, but a whole range of activities have been uncovered from one with a half-life of 4 hours to one with a half-life period of only 12 seconds. Substances with short half-life periods are expected to be very valuable in the medical applications of these substances. The report was a supplement to a scientific paper on the high-voltage production of positive ion and electron beams with the giant electrostatic generator of the Massachusetts Institute of Technology. The research was done by Dr. Robert J. Van de Graaff, Dr. Lester C. Van Atta, Dr. Chester M. Van Atta and Doyle L. Northrup. Evidence of the new activities was detected with the generator operating at a little under 1,000,000 volts, considerably lower than had been expected, and the yield mounted rapidly as the voltage was increased. Indium is a rare metal with properties similar to aluminum. It is silver-white in color, softer than lead and about the same weight as tin. It is found chiefly in zinc sulphide or zinc blende ores.—ROBERT D. POTTER.

THE FIRST EXPLORING EXPEDITION TO ANTARCTIC CONTINENT

A CENTURY of American leadership in Antarctic exploration was celebrated on February 23, at the hall of the American Philosophical Society. The expedition was that led by Lieutenant Charles Wilkes, of the U. S. Navy, who gathered geographic, meteorological and other scientific data along 1,500 miles of Antarctica's desolate shores during the years 1838-1840.

Captain G. S. Bryan, U. S. N., stated that the expedition was authorized by the Congress, largely in response to demands from whaling industry for better maps and navigational information. There was Congressional opposition, then as now, to spending money for scientific research. Funds were cut, unsuitable ships had to be used, clothing and other stores were inadequate. Fortunately, however, the scientific instruments carried were excellent, and the nine scientists who constituted the technical personnel of the expedition did their work well, so that most of the results obtained are still valid.

Worthy of note also is the fact that the government sought the advice of the then existing scientific organizations in planning the expedition. Particularly active were the American Philosophical Society, which had been founded by Benjamin Franklin in pre-Revolutionary days,

and the Academy of Natural Sciences of Philadelphia. An account of this phase of the expedition was given by Dr. Edwin G. Conklin, vice-president and executive officer of the American Philosophical Society, and by Dr. James A. G. Rehn, corresponding secretary of the Philadelphia Academy.

Although the Wilkes expedition was the first to conduct long exploration in the Antarctic region, and to prove the continental nature of the South Polar land mass, it was not the first to find land in the region. Honors for that accomplishment go to another American, Nathaniel Brown Palmer, a Connecticut sealer, who found that part of Antarctica nearest South America on November 18, 1820, and explored some 450 miles of the frozen coast during the following January. The work of this "Columbus of Antarctica" was described by Colonel Lawrence Martin, chief of the division of maps, Library of Congress.

Although it was long before the era of daily weather reports, the meteorology of Antarctica was intensively studied and minutely reported by Lieutenant Wilkes, declared Commander F. W. Reichelderfer, chief of the U. S. Weather Bureau. Commander Reichelderfer also told of the expedition's permanent contributions to science, in the form of geomagnetic and gravitational data.

The expedition did not confine its work entirely to the Far South. After the work along the coasts of Antarctica was completed, Lieutenant Wilkes took his ships far up into the Pacific, as far as the Puget Sound region and the coasts of British Columbia. Various phases of this part of the long voyage are the subjects of papers by Mary E. Cooley, of Mount Holyoke College; Henry W. Fowler, of the Academy of Natural Sciences of Philadelphia, and Professor John E. Hoffmeister, of the University of Rochester. The fishes brought back by the expedition are still preserved in the U. S. National Museum.

Continuation of the program was devoted principally to accounts of later polar expeditions, Arctic as well as Antarctic. A special feature was an address on "Glaciers of the Antarctic," given by Professor Laurence M. Gould, of Carleton College, who was senior scientist and second-in-command of the First Byrd Antarctic Expedition.

THE FISSION OF URANIUM AS A SOURCE OF ATOMIC POWER

A POWER house for potent neutron particles—a laboratory piece of equipment for the generation of these neutral atomic particles that are perhaps the best of all weapons with which to bombard the elements and produce artificial radioactivity and transmutations—is what Professor Enrico Fermi, of Columbia University, sees in the new atomic process of uranium splitting.

Discussing for the American Society of Mechanical Engineers the fission of uranium and its possible application as a source of atomic power, Professor Fermi said that "The large release of energy by the reaction . . . is probably only one and very likely not the most important aspect of the problem. Far more important might eventually prove the production of radioactive materials and of neutrons in practically unlimited amounts, for medical, biological and physical investigations. . . . Although there

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is only a chance of success on these lines the stake appears large enough to justify some gambling on the part of scientists."

The "gamble" of which Professor Fermi speaks is the success or failure of experiments testing whether uranium, in its splitting, gives off other neutrons which can split other uranium atoms and so on in a chain reaction. If this self-perpetuating kind of chain-reaction can be created and kept under control in scientific laboratories, then one may expect all top-flight physical laboratories of the future to have uranium-fission neutron sources. All that would be needed would be a small supply of radium placed in a mixture of beryllium. This radium-beryllium source would supply the initial neutrons for starting the uranium fission just as the pilot flame on a gas stove starts the gas to burning.

Surrounding the radium-beryllium neutron source would be water or paraffin to slow the neutrons and also the "fuel" of the process, cheap uranium oxide ore. To start the neutron generator one would place the radium-beryllium source at the center of a container of the uranium. Once the chain reaction started this original source would be removed. The uranium would undergo splitting with the liberation of the desired neutrons. To stop the process would require only the insertion, by mechanical means, of sheets of cadmium metal which has the ability to capture and stop the low-energy neutrons strongly.—ROBERT D. POTTER.

THE PROTECTION FROM FROST OF SMALL VEGETABLES

A TRANSPARENT "hotcap" for the protection of tender young vegetable plants in northern latitudes has been developed by Professor Albert E. Wilkinson, extension specialist in vegetable and landscape gardening at the University of Connecticut. He tried them experimentally in his own garden last year and now is urging their use by commercial and home gardeners.

The miniature hothouses are made from cellulose acetate sheeting which can be purchased commercially. It is also the material from which the base of amateur moving picture film is made. A triangular piece of the material is fashioned into a simple cone. The apex of the cone is snipped off to provide ventilation. A piece of wire bent into a hook is then thrust into the ground through this aperture and holds the cone in place. The hotcaps can be made at home with no tools but shears, wire, wire cutters and paper clips to hold the edges of the material together in the cone shape. The edges can be cemented together with liquid cellulose acetate instead of using paper clips.

Hotcaps are used to cover small plants of cabbage, broccoli, tomatoes or other vegetables that are susceptible to frost. They may also be used over seedlings of melons, cucumbers, sweet corn or early squash, and make it possible to plant these vegetables much earlier than would otherwise be possible.

Paper has been used extensively for this purpose in the past and serves adequately to protect the plants from cold temperature. The advantages of the cellulose acetate hotcap are: It admits the sun's rays, hastening growth. It

permits the gardener to see whether the plant is developing without removing the hotcap. With reasonable care it can be used for several seasons.

ITEMS

SURPRISING numbers of slow mesotrons, atomic particles found in cosmic rays, were found during an airplane flight that rose to 29,300 feet in order to take cloud-chamber photographs of cosmic rays, Gerhard Herzog and Wiston Bostick, Ryerson Physical Laboratory of the University of Chicago, report in *The Physical Review* issued recently. Hint of other particles being present in the cosmic rays at these high altitudes is contained in pictures that show stronger ionizing particles which may be protons, alpha particles or still heavier nuclei.

A CHEMICAL related to sulfanilamide, known as phenothiazine, has been found highly effective in the treatment of several species of parasitic worms in livestock by investigators at the U. S. Department of Agriculture. As soon as manufacturers make suitable application to the secretary of agriculture, it will be released as an accepted veterinary medicine. Phenothiazine first came into scientific notice half a dozen years ago when it was found to be highly toxic to insects and very slightly so to warm-blooded animals. This original research was carried out by L. E. Smith, of the Bureau of Entomology and Plant Quarantine. Investigations since then indicate that it is one of the most versatile chemicals brought to light in recent years. In addition to its effectiveness against insects, worms and other cold-blooded forms of life, phenothiazine has been found to have marked fungicidal and bactericidal properties. In the latter field, it has been used as an internal antiseptic in human medicine, in the treatment of cystitis, pyelitis and allied diseases. Researches on the use of phenothiazine in human medicine have been conducted by Dr. Floyd DeEds, of the Stanford University School of Medicine, to whom a public service patent on this phase of its applications has been granted.

MIMOSA trees, whose bright flowers and delicate, feathery, gray-green foliage are a delight to winter sojourners in southern resorts, are menaced by a new disease, apparently caused by a soil-dwelling fungus. Little is known about the disease, except that it kills the trees very quickly and spreads rapidly. Its center of distribution, reports Dr. George H. Hepting, of the U. S. Department of Agriculture, is at Tryon, N. C., and dead trees have been found as far north as Richmond, Va., and as far south as La Grange, Ga. Diseases that may be early stages in tree-killing epidemics are also being studied in willows, oaks, shortleaf pines, Monterey cypress and Douglas fir. Two diseases menace the American elm, and the London plane tree, favorite in cities because of its resistance to smoke, are under attack in centers along the Atlantic seaboard. Millions of dollars are being spent to save white pines from blister rust. The persimmon, whose wood is unequaled for golf club heads, will probably soon join the already extinct native chestnut. America's trees are in greater danger than most Americans realize.

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SCIENCE NEWS

Science Service, Washington, D. C.

THE 1940 ICE PATROL SEASON

THE 1940 ice patrol season is beginning in the North Atlantic, with four U. S. Coast Guard cutters on duty. The *Chelan*, *Cayuga* and *Ponchartrain* will ply the steamer tracks, looking for icebergs and other menaces to navigation, while the *General Greene* will gather oceanographic and other scientific data.

Because of the European war, difficulties have been multiplied for the ice patrol. In normal times, its vessels base at St. John's, Newfoundland, thus saving a great deal of time and fuel in getting to and from their stations at sea. However, because the cutters are armed, it has been considered best for them to keep away from ports of belligerent powers, and they will base in Boston and New York. Only the *General Greene*, whose exceedingly light armament "doesn't count," will continue to use the Newfoundland port.

Even more serious will be the absence of cooperation by freight and passenger vessels. In peace time, any ship that sights an iceberg radios its location at once to the ice patrol vessel on duty, which collates all such information and sends out general ice broadcasts for the benefit of all shipping. Now, however, all shipping of belligerent powers, and most neutral vessels as well, are keeping a strict radio silence lest they betray their positions to Nazi submarines. So the ice patrol will have to find all its own icebergs.

The radio silence will help in just one respect. Ordinarily it is necessary to request all shipping to suspend radio sending while the ice broadcasts are on the air. Now they have the whole air to themselves without asking for it.

From such meager information as it has been possible to obtain so far, it appears that the 1940 ice season is starting in more or less normal fashion. Very little ice has been reported. Last spring was one of the heaviest ice years of record; the ice patrol had to go on duty nearly a month early. It is fervently hoped that 1940 will be a low ice year, because with cooperation from shipping wiped out by the war, and convoys taking unorthodox tracks to keep away from possible submarines, the menace from any given iceberg will be increased many fold.

In addition to the ice broadcasts, the vessels of the ice patrol also send frequent weather reports to the U. S. Weather Bureau. This part of their activity is not particularly relished by the British Admiralty, because Britain is doing its best to maintain a "weather blockade" of Germany, and of course Nazi antennae can also pick up these North Atlantic weather reports. However, since the information is particularly desired in this country for its usefulness to the navigation of the clipper planes, the messages will continue to be sent, regardless of objections.

A REMOTE ACTING THERMOMETER

(Copyright, 1940, by Science Service)

A NEW kind of remote acting thermometer, that can

measure the temperature of distant objects without going near them, has been developed by Dr. John Strong, of the California Institute of Technology.

The new device is a pyrometer. This name is a misnomer, in part, for ordinary pyrometers are commonly used only for measurements of temperatures of extremely hot objects such as the molten metal of an open hearth furnace in a steel mill.

As a metal gets hotter and hotter, it turns to dull red, bright red and finally virtually white in color. An ordinary pyrometer uses this change of radiation wave-length (for that is what the different colors mean) to determine temperature.

Dr. Strong's new instrument simply applies this procedure to invisible radiation wave-lengths in the very far infra-red region of the spectrum. His pyrometer is useful in the temperature range from minus 100 degrees Centigrade to the temperature of boiling water, with an accuracy of 0.1 of a degree Centigrade.

To measure temperatures with the new pyrometer a small telescope attached to the device is pointed into the wide-mouthed neck of a jug of melting, cracked ice. This gives a reading on the scale of the instrument corresponding to a temperature of zero degrees Centigrade.

Next the telescope is pointed at an opening in an ordinary five-gallon oil can containing live steam. The reading on the instrument is noted for this known temperature of 100 degrees Centigrade. Finally the object, whose temperature is to be measured, is picked up in the telescope and it produces a given reading on the instrument.

Knowing the two fixed temperature point readings (melting ice and steam at 100 degrees) one needs only to look on a conversion chart at the point observed by the instrument for the given object and its temperature can be read off.

In principle the new pyrometer is an infra-red spectrometer which—by means of a grating and multiple reflections off suitable crystal surfaces—picks out the single infra-red radiation wave-length of 8.8 μ (1,000 μ corresponds to wave-lengths one millimeter long). The emission of this particular wave-length in the infra-red region by the ice, the steam and the object whose temperature is being measured, is used and correlated into a final temperature reading.

Important applications await the new instrument. It can be applied for temperature measurements on objects that are inaccessible for ordinary thermometer devices.

It can be used, too, in meteorology to make determinations of the water vapor content of the atmosphere. In astronomical and terrestrial physics new uses are being studied.

THE PRODUCTION OF MAGNESIUM AND MANGANESE

Two metals, magnesium and manganese, not now plentifully used in their pure state by American industry, promise to be available at reasonable prices as the result of production of cheap electrical power by Grand Coulee and

Bonneville dams in the Pacific Northwest. Promising deposits of ores of those metals occur in that region.

As a metal, magnesium has been known in the past as old-fashioned flashlight powder. But it is a true metal of the future because it weighs two thirds as much as aluminum and less than a fourth as much as steel, yet its alloys of extremely light weight have working properties similar to steel. Ultralight magnesium alloys promise to find extensive use in the construction of airplanes and automobiles, portable tools, and all sorts of machinery, furniture, novelties, etc., as soon as the price becomes less as it promises to do when hopes for its production in the Pacific Northwest are realized.

Processes for extracting metallic magnesium using cheap electrical power have been under development jointly by the State College of Washington and the U. S. Bureau of Mines at Pullman. From Washington magnesite, the magnesium metal can be produced by two different processes, one of which is similar to an Austrian process of direct carbon reduction the details of which are a closely guarded military secret. The cost of producing on a large scale of operation high-purity magnesium metal would be only 8 to 10 cents per pound compared with the selling price of about 28 to 30 cents per pound now in carload lots and \$5 per pound in 1915.

High-purity metallic manganese, useful for steel alloying and the nonferrous alloy industry, can be produced from the high silica manganese ore of the state of Washington. Already in pilot plant production at Boulder Dam by the U. S. Bureau of Mines, it has been estimated that commercial production on a large scale would see manganese metal at 7 to 9 cents per pound compared with the present 40 to 50 cents per pound.

High manganese alloys are reported to have a springiness unrivaled by any other metal, a vibration damping capacity more than 100 times that of steel. Copper alloys that can be hardened depend on a content of manganese for this property. The greatest use of pure manganese would be in making many alloy steels, to which manganese is already essential without adding to them other elements such as carbon, aluminum and silicon, hitherto present in available forms of manganese.—WATSON DAVIS.

MORE EFFICIENT STEAM TURBINES

(Copyright, 1940, by Science Service)

MORE efficient and safer steam turbines, meaning cheaper electricity for every one, should come from the new, full-sized but completely experimental turbine installation displayed at the Schuylkill Generating Station of the Philadelphia Electric Company.

The man behind this research, expected to furnish the bedrock of experience for to-morrow's sources of power, is F. T. Hague, engineer of the Westinghouse Electric and Manufacturing Company. In his laboratory studies he had pushed turbine steam operating characteristics up from 250 pounds to the square inch of pressure and temperatures of 600 degrees Fahrenheit (1920) to 1,250 pounds pressure and temperatures of 900 degrees—hot enough to melt lead. What he needed for a final test was a life-sized installation and a plant boiler capacity which could create the 125 tons of steam needed, each

hour, to run such an installation. The plant of the Philadelphia Electric Company provided such capacity.

Moreover, this installation had to have some means of looking inside it and seeing how the turbine blades were vibrating under the extreme shock. "To form a mental picture of this shock," Mr. Hague explains, "imagine a turbine blade moving 350 miles an hour abruptly entering a steam jet density moving 1,200 miles an hour." Oscillations at the rate of 126,000 times a minute occur in the blades, or 181,440,000 per 24-hour day.

Just as trees sway in a gale, so too do the turbine blades sway and vibrate under this super-hurricane of hot, "live" steam. If the vibrations are just right the blades enter into what engineers call resonance. Eventually they break off as their sway becomes greater and greater. If conditions are properly arranged, however, the vibrations can be kept out of resonance and the blades will not break. But to determine this resonance and non-resonance condition engineers have to be able to look inside and see what is happening. While the turbine blades are whirling some 60 revolutions a second around the turbine shaft an automatic camera takes pictures through a tiny quartz window in the shaft at the rate of two a second.

"With this new apparatus," Mr. Hague explains, "a beam of light is carried through the shaft of the turbine and up into the blade itself, where mirrors reflect it out again, faithfully recording all vibrations. In this manner the harmonic movement of the blade can be recorded on film for any stated condition of operation. The light beam, supplied by an arc lamp, is deflected by a stationary mirror into the rotating shaft," he pointed out. "A slanted mirror inside the shaft throws the light beam through a hole in the rotor disc and then through a smaller hole inside the blade, towards a small curved mirror on the end of the blade. This curved mirror sends back the light by way of the slanted mirror in the shaft, to a screen. When the turbine rotates without vibration, the light point on the screen describes a circular path. But when the blade vibrates, the curved mirror mounted on the end of the blade deflects the light beam away from this path and waves or notches appear on the circle. The wavy circle described by the light is recorded on film by a specially designed speed camera. By study of the resulting pictures the stresses on the blades are deduced directly from the magnitude of the waves by proper calibration. By shifting the mirrors, it is possible to measure side-to-side as well as back-and-forth vibrations."

THE CHEMICAL CONTROL OF CANCER

A STEP toward the control of cancer by chemical treatment is announced by Dr. Leonell C. Strong, of Yale University School of Medicine, in a report published in *The American Journal of Cancer*.

So far the results apply only to mice, but they indicate the possibility of success in chemical treatment of cancer in other species, because they show that the same chemicals can affect cancers, leaving adjacent normal cells untouched, regardless of the genetic origin of the mouse.

Growth of spontaneous cancers in six different strains of mice was slowed, and in some cases the cancers liquefied, while in others they disappeared completely, when the two

chemicals, methyl salicylate and heptyl aldehyde, were added to the animal's food. This shows, Dr. Strong explains, that tissue specificity, a fundamental factor in cancer development, will not impede chemical control of the malignant disease if a chemical that will check or reverse the malignant process can be found. In other words, even though there is an intrinsic genetic factor which plays a part in predisposing an individual to cancer, the cancer can be controlled by chemical attack. The chemicals probably could not change the genetic factor predisposing to cancer, but by their effect on other fundamental aspects of the cancer, they could check the malignancy.

This work is the logical development of similar work on the use of true oil of Gaultheria and of heptyl aldehyde used alone, which has been reported by Dr. Strong during the past several years. The next step toward the chemical control of cancer, Dr. Strong says, will be to find a combination of pure chemicals which have the maximum effect on cancers in laboratory animals. After that it may be time to talk about the chemical control of human cancers.

ITEMS

FINLAND, to-day in the limelight as a country which has done well with meager resources, appears to owe its success partly to a declining birth rate and emigration, both of which have kept down the crowding of farm population. A report to the *Population Index*, published at Princeton, N. J., shows that the Finnish birth rate has tobogganed an irregular but mainly downward course for two centuries. From 45 births per 1,000 population in mid-eighteenth century, the birth rate stood at 20 per 1,000 in 1937. Thanks to the Swedish parish system of registering vital statistics, Finland has a continuous record of births and deaths from 1750, to show trends. Characterizing Finland as predominantly rural, though with a strong recent trend toward city and industrial development, the report says that most of Finland's farmers hold small land areas, but three fifths of the farm families own their land. Only seven per cent. of the land is cultivated. The soil is thin, deficient in lime and phosphorus. Marshlands are so acid that it takes generations of cultivation to make them productive. Factors which have enabled the Finns to achieve a reasonably satisfactory adjustment of population to their resources without extreme wealth or extreme poverty include intelligent use of these meager resources, the cultural level of the people, forward-looking social legislation.

DISCOVERY of what makes the prick when you stick yourself with a pin, or what makes the hurt of a small cut, has been announced by Drs. Sol Roy Rosenthal and David Minard, of the Municipal Tuberculosis Sanitarium and the University of Illinois College of Medicine. The pricking sensation, the hurt of a cut and the pain of a skin burn or a playful pinch are due to a chemical, called histamine, which is liberated when the skin is injured and which then acts directly on the endings of the sensory nerves, causing them to send the pain or prick message to the brain. The discovery is reported in the current issue of the *Journal of Experimental Medicine*. The superficial layers of skin were removed over a small area,

and about an hour later the chemical, histamine, was dropped onto the surface. Very weak histamine solutions, of a dilution of 1: 60,000, gave a slight tingling, pricking or burning sensation. With more histamine in the solution, the burning or pricking sensation was more marked and acute pain was felt. Injecting histamine into the skin gave the same results. When tissue-paper-thin layers of skin, shaved off, were stimulated by 10-second electric shocks, histamine was liberated, as shown by finding it in washings from the skin.

BLACK ducks can dive for food on the bottom of water as much as ten feet deep, it has been demonstrated by Harry Leon Kutz, of Cornell University. Mr. Kutz will report his observations in the forthcoming issue of the *Journal of Wildlife Management*. The feat of this common wild duck species is all the more remarkable because as a rule black ducks do not dive for their food at all, preferring to gather their food ashore. However, when Mr. Kutz dropped corn in water at depths of five, seven and ten feet, the black ducks competed successfully for it with mallards at the two shallower depths, and monopolized it at the ten-foot level. That such a dive was not easy for the black ducks is evident from Mr. Kutz's description: "Preceding each dive a bird would assume a definite stance with neck fully extended upward and muscles tensed. Then with a powerful kick from both feet it would disappear beneath the surface of the water, the kick causing a splash of no inconsiderable proportions."

SUCCESS in the treatment of abscessed teeth with the chemical remedy, sulfanilamide, was reported by Dr. Fred R. Adams, of New York, to the recent Philadelphia Dental Meeting. One injection of a hot sulfanilamide solution directly into the abscess killed all the trouble-making germs in every case but two. One case required two such treatments and another, three. Some of the abscesses that were cleaned up in one treatment had persisted for 10 years. X-ray pictures of these cases showed that after a few months new bone had grown to fill the area formerly occupied by the abscess. Heating the sulfanilamide solution for treatment is important. A stronger concentration of the drug can be obtained in hot water and the heat reinforces the chemical's action on the germs. This method of using a hot sulfanilamide solution for irrigation should, in Dr. Adams' opinion, be useful in treating infections in other parts of the body, such as sinus infections and the bone diseases osteomyelitis and osteitis and in cellulitis involving bone.

A NEW kind of printer's ink that is sold in chunks, looks like coal when broken up for use, and may revolutionize printing by speeding up the process and turning out clearer print for reading, was described recently. A "cold setting" ink, the new printing material dries instantly on paper as it comes through the presses, according to Frank B. Breyer, chemical engineer of New York City, who spoke before the Technical Association of the Pulp and Paper Industry. Cold setting, he explained, reverses usual tactics of heating the paper, in order to dry the ink when the printed sheet runs over high speed rotary presses.

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SCIENCE NEWS

Science Service, Washington, D. C.

THE COMPOSITION OF THE SUN

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NEW knowledge of the composition of the sun should be secured from observations which will be made during the "ring eclipse" of the sun that will occur on April 7, according to Dr. Otto Struve, professor of astrophysics at the University of Chicago and director of both the new McDonald Observatory on Mount Locke, Texas, which is conducted jointly by the University of Texas, the University of Chicago and the Yerkes Observatory.

Usually a "ring eclipse," in which the moon's diameter is not of apparent sufficient size to obscure completely the sun's disk and produce a total eclipse, is of little scientific worth and is regarded more as a pleasing spectacle.

Now being constructed at McDonald Observatory, however, is a new instrument for observing the invisible "infra-red" radiation emitted by the rim of the sun during the ring eclipse. During such an eclipse the much stronger radiation from the center of the sun's disk is blocked out and permits scientists to measure the radiation coming from the rim, or "limb," as it is called. Dr. Struve reports that it is only during a partial or annular (ring) eclipse that this rim radiation can be measured.

McDonald Observatory will be in the zone where the ring eclipse can be seen, but is about 50 miles from best observing position. A special expedition will be sent out to make the infra-red measurements. At the observatory itself will be mounted the television apparatus invented by Dr. A. M. Skellett, of the Bell Telephone Laboratories, for observing the corona of the sun during the eclipse.

THE WEATHER PATROL

FIRST to return from duty as a floating weather observatory at sea, the U. S. Coast Guard Cutter *Bibb* has returned, and investigators of the U. S. Weather Bureau are evaluating results and preparing for another tour to begin on March 18.

The *Bibb* and her sister ships of the "weather patrol" go to a certain spot in the Atlantic and stay there for three weeks, obtaining all possible weather information and relaying it back to the Weather Bureau, where it is made available for the use of the mail-carrying Atlantic clippers and for surface shipping of all nationalities.

The principal instrument used is the radiosonde, a featherweight robot radio sending station that goes up on a small unmanned balloon and automatically sends back information about the weather from altitudes as great as ten or fifteen miles. Once every 24 hours a radiosonde is sent up, at 10:45 P.M. Also, at six-hour intervals, smaller balloons are sent up, which are watched through theodolites as long as they can be seen, to give further information on wind direction and velocity. Finally, constant records are made of weather conditions at the surface, and of ocean temperatures.

The two cutters that have been at sea, the *Bibb* and the *Duane*, were stationed along the course of the Atlantic

clippers, respectively one third and two thirds the distance to Europe. The great flying boats passed over them at night, taking their bearings from the brilliantly lighted ships as if they were land beacons. Constant radio communication is of course maintained between aircraft and surface craft, so that the precise location of the latter is known in the clippers' navigation cabins.

The *Bibb* and the *Duane* have been relieved by two other Coast Guard cutters carrying U. S. Weather Bureau men and equipment, the *Hamilton* and the *Ingham*. These will stay at sea until it is time for the first pair to take their place.

HIGH-SPEED CENTRIFUGES AND THE DIAGNOSIS OF DISEASE

(Copyright, 1940, by Science Service)

FORCES equal to 8,000,000 times gravity that can be created in modern centrifuges have promise of being a new medical tool for the diagnosis of disease, according to a statement made by Professor J. W. Beams, of the University of Virginia, in a lecture given before the Sigma Xi chapter of the College of Medicine, University of Illinois.

Professor Beams stated that under the terrific centrifugal forces created in the whirling rotors of modern centrifuges, it has been found that the viruses of tobacco mosaic virus (a plant disease) and the vaccinia virus (cowpox used for immunization against smallpox) can readily be separated and purified. Interesting differences in the number of sedimenting boundaries, as well as the relative concentration in each, between normal and pathological sera have been found. It is not impossible that the centrifuge may be very useful as a means of determining the correct diagnosis of disease.

Professor Beams, who is an authority on the construction of ultra high-speed centrifuges, explained that these devices are highly successful in separating out fractions of complex body proteins. These proteins appear to be composed of homogeneous species of molecules which seem to be definite multiples of a fundamental protein mass unit of 17,600.

The extremely large protein molecules which occur in the bodies of living things represent stable collections of lesser molecules held together in a fragile bond that can easily be changed by many factors including the pH, or acidity, of the medium in which they exist.

An example Professor Beams discussed was the coloring pigment of the blood of the common, edible European snail. This pigment, haemocyanin, has the enormous molecular weight of 6,740,000. When its acidity is changed slightly, Professor Beams said, "it dissociates by steps into halves, eighths and sixteenths, each dissociation product being a homogeneous molecular species. When the pH (acidity) is changed back to the original value, the components recombine to form the original compound of molecular weight 6,740,000." The ultra high-speed centrifuge is invaluable in determining accurately these large molecular weights.

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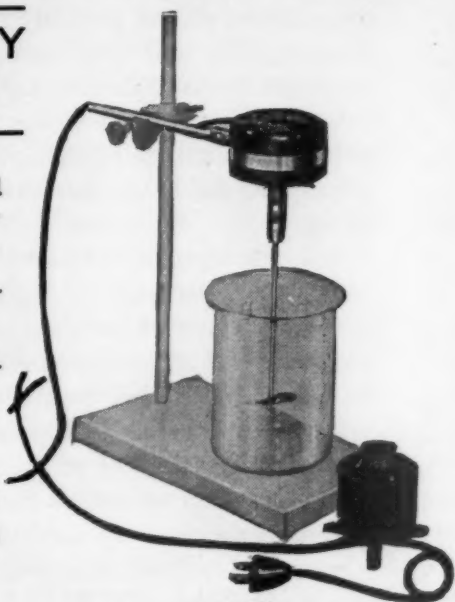
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Other valuable uses of centrifuges, outside the field of physics which designs and creates them, are in the purification of hormones, viruses and enzymes, and in the determination of the masses of the artificially radio-active isotopes of the elements which are increasingly being used in chemistry, biology and medicine as "tracer" elements to study complex and hitherto-obscure reactions in plants, animals and chemical compounds.

THE CAUSE OF CANCER

(Copyright, 1940, by Science Service)

PROBING for the secret of how normal healthy cells in a human body are transformed by a chemical into malignant cancer cells, Drs. Wilton R. Earle and Carl Voegtlin, of the National Cancer Institute, U. S. Public Health Service, have achieved the test-tube transformation of one type of living cell into what appears to be a radically altered type. Whether their cellular alchemy has created cancer cells out of normal cells remains to be proved. The new cells, however, have at least many of the appearances and characteristics of cancer cells. This transformation is important scientifically because it is the first time it has ever been accomplished, outside the body, with mammalian cells.

The new type of cells was produced by growing mouse cells in flasks and treating them with methylcholanthrene. This substance is a powerful coal-tar chemical which causes cancer when injected into or rubbed on the skins of mice or other laboratory animals. It is similar to the substance in coal tar which causes the kind of human cancer known as chimney sweepers' and spinners' cancer.

Since the cells that were transformed by the chemical were outside the animal's body, the experiments show that the chemical probably causes cancer by direct action on the cells, independent of any general systemic action. In other words, the chemical causes cancer by its own contact with the cells and not by indirectly producing changes in general body chemistry which in turn might cause cells to become cancerous.

A significant feature of the transformation of normal mouse cells into this type is the fact that the chief changes so far observed in the cells seem to suggest changes in the cell membrane or envelope. It is suggested that this might be a crucial change in the transformation of a normal cell into a cancerous one by chemical treatment.

THE TREATMENT OF SHOCK IN SURGICAL OPERATIONS

(Copyright, 1940, by Science Service)

SAFER surgical operations and speedier recovery from them, especially for debilitated patients, seem promised by a new treatment for preventing dangerous shock during and after operations. The treatment, using a synthetic adrenal gland hormone, was developed by Dr. David Perla, of Montefiore Hospital in New York City. "Striking benefits" in fourteen cases at this hospital are reported by Dr. Perla, who said that the treatment will shortly be adopted in two other New York City hospitals.

The patients treated at Montefiore were what would be considered poor surgical risks because serious chronic illnesses such as cancer and tuberculosis had weakened them

so that they would have little strength to withstand an operation. Without the new treatment, patients of this type might have had to forego the chance of being helped by surgery because the shock of the operation might cause fatal prostration and collapse.

With the new treatment, patients are prepared for operation by being given quantities of salt solution and carefully prepared doses of desoxycorticosterone acetate. This chemical is the synthetic vital hormone of the adrenal glands. Earlier studies have shown that these glands play a significant rôle in the body's fight against intoxications, poisons, shock and infections. The adrenal cortical hormone, Dr. Perla explained, influences the transfer of water from tissues to cells and the level of salt in tissues and cells. Disturbance of this glandular balance, which frequently occurs in an exhausting operation, leads to collapse.

"In all instances the patients were strikingly benefited," Dr. Perla said in his report of the new treatment. "There was no objective evidence of shock. The blood pressure was maintained or elevated. The temperature in general returned to normal within 24 to 48 hours. Post-operative exhaustion and toxemia were definitely lessened. Complications did not occur. Operative recovery seemed to the surgeons concerned to be more rapid than in their preceding surgical experience in our hospital."

FEDERAL HOSPITAL CONSTRUCTION

THAT plans for a national health program, supported and coordinated by the Federal Government, should not be abandoned now that a more modest plan for federal hospital construction has been proposed, is the opinion of the Committee of Physicians, according to a statement issued by its secretary, Dr. John J. Peters, of the Yale University School of Medicine.

The plan to have the Federal Government spend \$10,000,000 to build hospitals in communities now lacking them was proposed by President Roosevelt and has been embodied in a bill introduced in the Senate by Senator Robert F. Wagner, of New York. Providing that this plan does not mean permanent abandonment of the national health program, the Committee of Physicians approves the hospital construction plan. The hospitals built under this plan should vary in size from 100 to 300 beds. Smaller hospitals probably could not offer comprehensive service. The statement points out that such hospitals should be directed by a lay hospital board representative of those persons in the community. Members of the board should be drawn from welfare organizations, social service and philanthropic agencies, public officials responsible for the care of the indigent and wards of the state or community, business men and industrialists of the locality and organizations of farmers or laborers, but no physicians who use the hospital should be on this board. There should, however, be a medical board, consisting of the chiefs of staff of the various services, to maintain and improve standards of medical care, control the use of hospitals by physicians and surgeons of the community and supervise their work. Physicians should be paid, preferably on a salary basis, for their services in these hospitals to the indigent, wards of the government and those

patients for whose medical care the community assumes total or partial responsibility.

Out-patient departments and other measures for integrating these hospitals with the public health services and general health programs of the community are recommended. Effective ambulance service, appropriate to the character of the community, should be provided.

A SYNTHETIC FIBER FROM SOYA BEANS

(Copyright, 1940, by Science Service)

OUT of the protein in soya beans two Japanese chemists have developed a strong synthetic fiber of high tensile strength which can resemble wool or natural silk, depending on production methods. The process is described in a new patent, No. 2,192,194, granted by the U. S. Patent Office, to Toshiji Kajita and Ryohei Inoue, of Tokyo.

Investigators in the U. S. Department of Agriculture express little surprise that a wool-like fiber can be created from soya beans, for it has been done experimentally, also, in the United States. The claims of a silk-like fiber are novel. While samples of the new Japanese fiber are not available, it is believed that this claim relates to the appearance of one form of the fiber which might be straight, without the kink of wool, and which might possess a sheen resembling that of silk.

Chemists, too, are interested in the new patent because it describes the use of the chemical, lecithin, to stabilize the protein solution prior to its ejection into a hardening bath. American investigators have found that with soya bean protein solutions a critical stage is reached where pectin is present. Pectin is often used by cooks to make jelly. If the pectin in the solution makes it gel prematurely the whole batch must be thrown out. If the Japanese can prevent this gelation with lecithin they have made a real advance in the synthetic fiber art.

Italy was the original home of wool-like fibers made from protein, and Italian scientific men introduced and perfected Lanital—made from milk. The protein of the casein in milk is the basic starting point for this product.

It has been pointed out many times that the protein of soya beans, or fish, or other sources might also be used for fibers, and world-wide research has progressed rapidly to perfect these other possibilities.—ROBERT D. POTTER.

ITEMS

THE possibility that some of the effects now attributed to heredity are due to prenatal environmental influence has arisen from cancer experiments in the Roscoe B. Jackson Memorial Laboratory at Bar Harbor, Me., soon to be reported. Unborn mice that are given foster mothers by transplanting fertilized eggs from one female to another are found to be "pseudo-hybrids" in that they react to transplanted tumors in part as their foster mothers do and in part as their real mothers do. Earlier experiments showed that in the process of nursing, whether the milk is supplied by the real mother or a foster mother, some sort of influence effecting the likelihood of developing breast cancer is transferred. Dr. Arthur M. Cloudman, who conducted the transplantation experiments as a part of a broad investigation of cancer's heredity directed by Dr. C. C. Little, is now planning to conduct experiments to

differentiate between the effects transferred during nursing from those acquired during the period before birth. First announcement of the experiments was made through the American Society for the Control of Cancer.

THE old tradition that a human baby dropped into deep water will swim is justified by scientific experiment, provided the infant is young enough. Babies a few days or weeks old were submerged in water in the test conducted by Dr. Myrtle B. McGraw, of the Normal Child Development Clinic at the Babies Hospital in New York City. They made rhythmical coordinated movements of both arms and legs "resembling swimming." The very young infant has a reflex which stops his breathing when he is under water. But after a few months the story is different. The older infant placed in water struggles in disorganized fashion. He tries to turn over on his back. He can not control his breathing. Towards the end of the second year, the baby has still another way of responding to the new experience of deep water. Now he makes deliberate swimming movements especially with his legs. The babies taking part in Dr. McGraw's experiment ranged in age from only eleven days to two and a half years. Animals, including opossum, kitten, rat, rabbit, guinea pig and monkey, made the same rhythmical movements of arms and legs. A complete report of the experiments was made to the *Journal of Pediatrics*.

PROFESSOR K. VON FRISCH, of the University of Munich, in a report published by the Smithsonian Institution, states that when a bee finds nectar she flies back to the hive and does an excited dance amid her fellow workers. These join her for a few steps and then make off for the new source of honey-material. Bees do not usually fly in a literal "bee-line" to the nectar supply after they have been told of it in dance-language. They seem to be guided by a special scent which the discoverer gives off from a controllable gland, in the neighborhood of the source of sweets. The other bees cruise more or less at random until they find this scent, then seek more specifically for the flower. Professor von Frisch has found in his researches that bees are color-blind to red, but that their eyes are sensitive to ultra-violet radiations.

THE U. S. Reclamation Bureau engineers have perfected a new, inexpensive method of hardening concrete surfaces, which compacts the concrete and avoids the forming of "voids" within it. They use "blotting" paper. To improve the surface of the spillways of its giant dams, over which billions of gallons of water glide yearly, government engineers tried a highly absorbent wall fiber board. They found the paper, unrolled on the spillway concrete while it was still soft, drew out excess moisture and allowed air bubbles to escape from the drying mixture. There is a double-action effect. The concrete dries more evenly, the fiber board remaining moist and protecting the surface. The resulting spillway surfaces were satin-smooth. Tests indicated that the concrete was unusually hard and wear-resistant. The new process was reported by C. O. Crane, assistant engineer of the bureau, to the Colorado Society of Engineers.

THE SCIENTIFIC MONTHLY

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CONTENTS FOR MARCH

- THE FUTURE OF MAN AS AN INHABITANT OF THE EARTH. PROFESSOR KIRTLEY F. MATHER.
 THE ROLE OF CHANCE IN DISCOVERY. PROFESSOR W. B. CANNON.
 NATURALISTS IN THE WILDS OF BRITISH COLUMBIA. III. JOHN F. and THEODORA C. STANWELL-FLETCHER.
 TWENTY-FIVE YEARS' QUEST OF THE WHALE SHARK. DR. E. W. GUDGER.
 SOME GEOGRAPHIC ASPECTS OF THE MANUFACTURE OF MEZCAL. DR. RAYMOND E. CRIST.
 EXPLORING THE CHEMICAL CAUSES OF CANCER. DR. GRAY H. TWOMBLY.
 THE SPACE IN WHICH WE LIVE. DR. PAUL R. HEYL.
 SCIENCE IN AN UNFRIENDLY WORLD. DR. W. JAMES LYONS.
 THE SOCIAL SIGNIFICANCE OF SCIENCE. HENRY M. WRISTON.
 MEDICINE IN THE BIBLE. DR. CHARLES WEISS.
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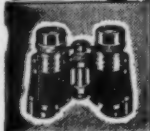
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SCIENCE NEWS

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PAPERS READ BEFORE THE NEW ORLEANS MEETINGS OF BIOLOGICAL SOCIETIES

THAT starvation treatment of wildly growing cancer cells, causing them to turn toward normalcy, has been accomplished in test-tube experiments, was announced by Drs. Richard H. Steckel and John R. Murlin, of the University of Rochester. This change from cell activity characteristic of cancer toward normal activity was made by starving the cancer of sugar through the use of insulin, the remedy for diabetes. The results, however, seem to be an important advance in the chemical attack on cancer. Changing the diet on which cancer thrives brought about this hopeful effect.

Slices of cancer from a rabbit were grown in blood from another rabbit that had been thrown into insulin shock by large doses of the diabetes remedy, such as are being used in insulin shock treatment of mental disease. This blood, as a result of the insulin treatment, is deficient in sugar. Its effect in reversing the cancer toward normal was explained in the following statement: "Unlike normal cells, tumor cells get their energy principally from fermentation of glucose to lactic acid instead of complete oxidation of the sugar. This was shown by Professor Otto Warburg, German Nobel laureate, and associates as early as 1923. Many attempts have been made to restore normal metabolism and thereby 'burn out' the tumor. Professor Warburg himself and many others used insulin on tumor-bearing animals, but with no clear indication of success. Recently this laboratory has undertaken the use of insulin in a different way, on the hypothesis that it should discourage the tumor's growth by: First, starving it of sugar for glycolysis and, second, promoting oxidation of sugar. The present experiments show merely that tumor slices placed in hypoglycemic (sugar deficient) serum have their oxidative metabolism markedly increased and the fermentation metabolism greatly diminished. Both are changes in the direction of the normal. The Brown-Pearce transplantable carcinoma of the rabbit was used and only young vigorously growing tumors chosen. Slices from the same tumor were studied simultaneously in serum from normal rabbit and from the same rabbit after being thrown into insulin shock. The effect on fermentation probably is due wholly to the lower blood (serum) sugar but the effect on oxidation may possibly be the result of a combination of factors. The experiments offer no proof that insulin will cure or prevent human cancer."

A NEW kind of double vaccine which gave "solid immunity" or resistance against several strains of influenza virus on its first trials was announced by Drs. Frank L. Horsfall, Jr., and Edwin H. Lennette, of the Rockefeller Foundation, New York. Up to the time of their departure for this meeting there was no evidence that efforts to produce the complex vaccine in a form suitable for protecting human beings against influenza would be successful. The success reported was in vaccination of ferrets. It is hoped that the work now under way at the

laboratories of the Rockefeller Foundation's International Health Division will succeed, and that hope is based on the particular make-up of the new vaccine. The vaccine is a double virus vaccine. It was made by grinding up the lungs and spleen of ferrets that had been given influenza by injections of "flu virus" germs. By accident, these ferrets got distemper at the same time they were given influenza. That may turn out to have been a lucky accident, because neither influenza virus nor distemper virus alone could be made into a successful anti-influenza virus. The complex nature of the vaccine, which is its strength, may be its weakness when it comes to vaccinating human patients. Neither Dr. Horsfall nor Dr. Lennette would take the risk of injecting ferret lung and spleen tissue. So they are trying to get the two viruses, influenza and distemper, to grow together on the membranes of developing chick embryos or if that fails, to grow them separately and then mix them into a vaccine. Animals other than ferrets were not protected by the new complex vaccine. This may have been because the vaccine was given to animals that are not susceptible to distemper. It is not yet known whether man is susceptible to distemper. But this may not make any difference so far as the success of the new vaccine is concerned, because it is not certain whether it was lack of susceptibility to distemper virus that caused its failure in animals other than ferrets.

BLEEDERS, from new-born babies to patients on the operating table and even, in many cases, hemophiliacs suffering from the hereditary bleeding disease, can now be saved by two substances presented by Dr. H. P. Smith of the State University of Iowa. One of the anti-bleeding substances is a new preparation so powerful that when sprinkled on a wound it stops bleeding by clotting the blood "in the twinkling of an eye." It is obtained from beef blood at the slaughter house which, after preliminary treatment, is whirled in apparatus like a cream separator. The fluid that separates out, called blood plasma, is diluted with water, treated with acid and other chemicals to purify it and finally sterilized by filtering through cakes of ground glass that is partially fused together. This material is so fast in action it will clot blood in one second. It is not yet on the market and the supply is still limited, but surgeons at the University of Iowa have already used it, with "quite encouraging" results, to stop dangerous oozing of blood during major operations. This oozing, which is difficult if not impossible to stop by other methods, is especially troublesome in operations on the brain, liver and bone. When the material is available generally, dentists will also be able to use it to stop bleeding after teeth are drawn. For hemophiliacs, like the Spanish Count of Cavodonga, who recently bled to death from injuries following an automobile accident, the new thrombin may prove life-saving. It can not stop internal bleeding, but in many cases hemophiliacs bleed to death from cuts on the surface of their bodies. This bleeding can be stopped

the new thrombin. Thousands of new-born babies and older patients suffering from obstructive jaundice can be saved from bleeding to death by the other substance that Dr. Smith discussed, vitamin K. This vitamin not only stops bleeding but if used properly will prevent bleeding. The vitamin was discovered by Professor H. Dam, of Copenhagen. Its chemical identity was determined and was prepared synthetically at the St. Louis University and the University of California. It was first used to treat patients by Dr. Smith and by physicians at the Mayo Clinic. A "bedside" test for determining when to use vitamin K to prevent bleeding was described by Dr. Smith. He urged doctors to use this test on patients who might bleed, so that the vitamin can be given in time to prevent the bleeding. For new-born babies, one out of every two or three hundred of whom are in danger of bleeding, vitamin K can be given during the first few days of life. The second to the fourth days are the danger period for these babies. Physicians at the Johns Hopkins Hospital in Baltimore, in Virginia and in New York are giving the vitamin to the mothers before the babies are born, to prevent the bleeding in the babies.

FOUR physically healthy American young women were given the first stages of the Oriental deficiency disease, beriberi, in diet experiments reported by Drs. R. D. Williams, H. L. Mason and R. M. Wilder, of the Mayo Foundation. They were given the disease by a diet almost completely lacking in vitamin B₁, or thiamin. Polished rice, sugar, tapioca, white bread, cornstarch, white raisins, egg white, cottage cheese and American cream cheese, butter, black tea and cocoa were the foods they ate for twenty-one weeks. Mental depression, lack of appetite, digestive disturbances, disturbed heart action and occasional tenderness of the muscles of the calves of the legs were the symptoms they suffered on this diet. All the symptoms disappeared promptly when they were given thiamin or vitamin B₁. Within a few hours they felt better and were hungry for food that had previously been nauseating. The severe neuritis and swelling characteristic of beriberi did not afflict these young women. This led one doctor to comment that if while on the diet they had gone to a doctor who did not know about the diet, their symptoms would have been diagnosed as neurasthenia or chronic nervous exhaustion. Many patients, it was suggested, may be suffering from lack of this vitamin. A patient suffering from what used to be called alcoholic insanity was also put on the same diet. His mental symptoms were all made worse, but he improved when vitamin B₁ was given to him. This condition, it is now known, is due to lack of the vitamin rather than to the alcohol.

A NEW vitamin, member of the large family of B vitamins but one whose existence has never before been suspected, was presented by Drs. A. G. Hogan, L. R. Richardson and Homer Patrick, of the University of Missouri. This vitamin, which has not yet been identified, is provisionally labeled vitamin B₁₂. It is concerned with the development and shape of bones. Without this vitamin in their diet, the bones of chicks are shorter and thicker than normal, and the chicks develop the disease

known as slipped tendon or perosis. Existence of the vitamin has been so recently discovered that its exact significance, other than for prevention of perosis in chicks, is still a matter of speculation. "Since it is concerned with the bone development and conformation of the chick, it may also be concerned with the structural development of other animals, and of man himself." The new vitamin was discovered in studies of the slipped tendon disease of chicks. The chemical, manganese, had been established as a preventive of this condition when fed liberally to chicks. By making an investigation of chicks that developed the slipped tendon condition, even on diets well supplied with manganese, and by studying the vitamin B food source in their diet, the existence of the new vitamin was discovered.

HOPE for high blood pressure and stomach ulcer patients appeared in discoveries announced at the meetings. For the stomach ulcer patients there will be the new hormone urogastrone, obtained from kidney excretions. Drs. A. C. Ivy, E. Wiczorowski and J. S. Gray, Northwestern University Medical School, reported that the first trials on ten normal persons showed that this hormone can stop the formation of acid by the stomach. At present, ulcer patients must take alkaline powders to neutralize the acid in their stomachs so that it will not irritate the ulcers and cause bleeding. The new hormone will be injected under the skin. Such injections at present cause swelling and reddening. Dr. Ivy and associates hope shortly to overcome this feature by further purification of the hormone, after which it will be ready for use in treating ulcer patients. The hormone treatment, by checking the acid in the stomach, will give the ulcer a chance to heal.

PATIENTS with malignant high blood pressure which could not be lowered by any other means, were helped by two new kidney extracts described by Drs. Irvine H. Page and O. M. Helmer, Lilly Laboratory for Clinical Research, Indianapolis, and Drs. J. R. Williams, Jr., T. R. Harrison and Arthur Grollman, Vanderbilt and the Johns Hopkins Universities. Not only was blood pressure reduced but the condition of the thickened arteries improved and the sometimes blinding eye disturbance accompanying very high blood pressure was cleared up.

A NEW chemical agent successful in protecting mice against streptococcus viridans, a germ unconquered by the sulfanilamide remedies, was announced by Dr. O. M. Gruhitz, of Parke, Davis and Company, Detroit. The new chemical remedy is sodium paranitrobenzoate. Although not yet tried on human patients, it may find a place in the treatment of certain diseases caused by streptococcus viridans, such as ulcerative or malignant endocarditis, a form of heart disease. Sodium paranitrobenzoate is relatively non-toxic to animals. Its therapeutic (curative) effect in mice infected with streptococcus viridans is of the same magnitude as produced by sulfanilamide in the beta hemolytic streptococcus infections. The sodium paranitrobenzoate has little or no effect in the latter type of streptococcus nor in pneumococcus infections.

DR. THEODORE FRIEDEMANN, of the University of Chicago, stated that the problem of why certain diseases, such as pneumonia and influenza, are more prevalent at one season of the year than another may be unraveled from the clues in his studies of chemical processes within the body of the pneumonia germ. In July and August lactic acid production by these germs rose to a peak of 95 per cent. falling to a low of 45 per cent. in January and February. Such a marked seasonal change in chemical activity is probably accompanied by "deep-seated changes in other functions" or activities. A study of such changes, especially as related to the many seasonal changes observed in animals, may throw light upon the perplexing problem of the seasonal occurrence of certain infectious diseases.

ARTIFICIAL sunlight can swiftly clear the air of tuberculosis germs floating about in it. Ultra-violet rays, within three seconds, killed 96 per cent. of the tuberculosis germs suspended in the air in experiments reported by Drs. William F. Wells and Max B. Lurie, of the University of Pennsylvania. Child and adult patients in hospitals and children in infants' homes and schools are being protected against germ diseases as a result of Dr. Wells's previous discovery of ways of applying the germ-killing power of ultra-violet light to such practical situations. With another of his inventions, a giant air centrifuge, he and Dr. Lurie measured quantitatively the number of tuberculosis germs in the air which when breathed by rabbits gave the animals the disease. Rabbits which inhaled 1,000 or more of the germs died of tuberculosis within five to six weeks, regardless of whether they were naturally highly resistant or highly susceptible to the disease. With smaller numbers of tuberculosis germs in the air, the rabbits got sick according to their natural resistance. When naturally susceptible rabbits breathed as few as 100 units of tubercle bacilli, they died of a type of tuberculosis similar to the childhood type of the disease. The naturally resistant rabbits, however, when exposed to the same number of germs developed a slowly progressing lung tuberculosis resembling the reinfection type of pulmonary tuberculosis in grown men and women.

FARM children in Florida, and other regions as well, are in danger of severe nutritional anemia if they live on home-grown food from poor soil that is deficient in iron. Such anemia is not primarily due to hookworm disease, as previously believed, according to Dr. Ouida Davis Abbott, of the Florida Agricultural Experiment Station at Gainesville, Fla. Hookworm infection affects the degree of anemia, but the prevalence of anemia among rural children in Florida is due primarily to diets low in iron. Anemia of children is so wide-spread that it has been called "the ubiquitous nutritional disease." From Nova Scotia, Massachusetts, North and South Carolina and Georgia as well as Florida have come reports of deficient soils and mineral deficiency diseases of cattle. Plants grown on such soils are lacking in iron and other blood-forming minerals. Both vegetables and meat from such regions, therefore, would be so low in iron that even children living on good diets would be

anemic if the diets were composed of home-grown food. Anemia was discovered in from 52 per cent. to 96 per cent. of rural children in Florida living in regions where the soil was predominantly deficient as shown by prevalence of salt sick of cattle. This age-old disease of cattle is known to occur when the animals are restricted to forages grown on certain white and gray sands and residual mucks known to be lacking in iron, copper, cobalt and perhaps other elements. Even though hookworm was wide-spread among the children in Dr. Abbott's study, many children with no hookworm were anemic they had only from about a fifth to a half the normal amount of red coloring matter in their blood. When iron was given to children with hookworm, most of the symptoms, such as pallor, marked weakness, excessive fatigue, loss of appetite and edema, gradually disappeared, even when the hookworm infection remained. On the other hand, clearing up the hookworm infection did not improve the quality of the blood.

ATTACK on the arthritis problem by experiments with mice and a new, unusual type of germ which gives the mice symptoms typical of human arthritis has progressed to the development of a vaccine that protects the mice against this experimental arthritis. Results of the vaccination experiments were reported by Drs. Albert B. Sabin, now of the University of Cincinnati College of Medicine and formerly of the Rockefeller Institute, and Dr. Isabel M. Morgan, of the Rockefeller Institute. "I can see no present or future application of these experiments to human arthritis," Dr. Sabin replied to a question on this point. Because the germ, a pleuropneumonia organism, belongs neither to the bacteria group nor the virus group of disease-causing microorganisms, Dr. Sabin's studies of it are interesting to those who want to know all about the strange new germ which, even if it may never affect human beings, causes diseases in the laboratory mice used for many studies of human disease.

THE occasional sudden death of a good swimmer upon plunging into cold water apparently is due to the effect of the cold water on the body's production of a chemical substance whose action resembles that of histamine. Tests made on five healthy swimmers by Dr. Grace M. Roth, section on clinical physiology of the Mayo Clinic, and Milton A. Gabrielson, special research fellow, furnished this explanation of such deaths. Swimming in cold water between 65 and 85 degrees Fahrenheit increases stomach acidity. This finding, however, fits in with previous Mayo Clinic discoveries about persons who are allergic or hypersensitive to cold. The latest findings, made on normal persons, indicate the dangers even when there is no allergy or hypersensitiveness to cold, and explains the mechanism of the sudden deaths, linking it with the chemical, histamine. When an enzyme that inactivates histamine is taken into the digestive system half an hour before immersion in cold water, the increase in stomach acidity is prevented. This shows that the sudden increase of histamine-like substances due to immersion in cold water is what causes the trouble. Histamine dilates the small blood vessels and lowers the blood pressure dangerously.

JAMES STOKLEY

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SCIENCE NEWS

Science Service, Washington, D. C.

THE ECLIPSE OF THE SUN

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FOR the first time in eight years, on Sunday, April 7, the entire United States will be able to see an eclipse of the sun. This coming solar display will be a partial eclipse over the whole nation. The nearer one lives to southern Texas and the Gulf States the larger will be the apparent "bite" which the moon will take out of the sun's disk.

In the 150-mile wide band that enters southern Texas, follows the Gulf of Mexico coastline and passes over northern Florida, will occur one of the unusual and pleasing annular, or ring, eclipses. For times varying from over 6 minutes to $5\frac{1}{2}$ minutes, observers in this band will see the black shadow of the moon nearly covering the sun's disk. The moon's diameter will cover 92 per cent. of the sun's diameter, to be exact.

This means that observers, during the eclipse, will see the sun as a thin ring of light instead of its flaming disk.

Farther north, outside of the annular band, observers will see a partial eclipse. Far to the north and west in Oregon and the state of Washington the moon will block out 40 per cent. of the sun's diameter. Other sections of the nation will see the partial eclipse as shown on the adjacent map. The symbols at the left show the relative size of the sun's disk that is covered.

The exact direction in which the moon will start to block out the sun's disk is not given on the map correctly for all observers because this direction differs for every locality.

The longest time in which the moon will nearly cover the sun's disk will be in southwestern Texas, where the duration of the eclipse will be 6 minutes, 37.6 seconds according to calculations at the U. S. Naval Observatory in Washington. As the eclipse progresses eastward along the annular band the duration becomes shorter and will be only 5 minutes, 38.8 seconds at the line marked off the coast of Florida.

For all those who view the eclipse smoked glasses, or a piece of photographic film exposed and densely blackened, are necessary. Serious damage can be done to the eyes by a glance at the sun's flaming surface without this aid.

There was a time when annular, or ring, eclipses such as that of April 7 were almost entirely without scientific interest. The progress of research, however, and advances in scientific instruments have made possible useful scientific observations on the coming solar event.

With special thermocouples and infra-red filters an expedition of the University of Chicago and the University of Texas will go from McDonald Observatory at Mt. Locke, Texas, down into better observing position and seek to study the faint light on the sun's limb (its outer edge) which is normally obscured by the much more brilliant rays from the center of the sun's disk. At McDonald Observatory, itself, will be set up the television apparatus invented by Dr. A. M. Skellett, of the Bell Telephone Laboratories, for viewing the sun even when

an eclipse does not occur. This device works well even when the sun's light is not blocked off by the moon. With an eclipse of about 90 per cent. magnitude scheduled for McDonald Observatory it is believed that even better pictures can be obtained because of the moon's help.

Journeying from Washington to near San Antonio, Texas, will be the expedition of the National Bureau of Standards and the National Geographic Society which will study the eclipse by radio signals and the behavior of the ionized reflecting layers far above the earth. With trailer-mounted equipment scientists will study the time of the radio "echo" signals during different stages of darkness.

At the Kensington Laboratory of Carnegie Institution's Department of Terrestrial Magnetism, Dr. L. V. Berkner will also investigate these radio reflections during the entire day of the eclipse. From the lower reflecting layers (at heights of 60 and 130 miles above the earth) it is hoped that data can be secured which will tell how fast the ions in the atmosphere recombine. In upper regions of the ionosphere (at heights of 220 miles) the general behavior of the reflections during the eclipse will be studied. Past investigations seem to show that there is no general pattern for this behavior during the previous eclipses. The eclipse at Kensington, just outside Washington, will be about 65 per cent. total.

Amateur astronomers can aid science by observing the time of first and last contact of the moon and the sun. To take this information so that it will have meaning, it is necessary to have an accurately calibrated chronometer for noting the time, and the exact geographical location where the observation was made. One can not simply go out in the backyard with a watch and do the job. Science Service will gladly forward the data obtained by amateurs to astronomical centers for study and possible use.—ROBERT D. POTTER.

HIGH PRESSURE

(Copyright, 1940, by Science Service)

SCIENTISTS stand at the threshold of experiments which should enable them to duplicate pressures encountered 745 miles down inside the earth, and double present world's record pressures of 3,000,000 pounds to the square inch and over.

The record high pressure, equaling pressures more than 100 miles within the earth, has been obtained by two scientists of the Carnegie Institution of Washington, Dr. Roy W. Goranson, of the Geophysical Laboratory, and Ellis Johnson, of the Department of Terrestrial Magnetism, with a "cascade bomb" apparatus. Their results virtually duplicate the high pressure of 3,000,000–3,500,000 pounds per square inch reported by Professor P. W. Bridgman, of Harvard University, in the *Physical Review* late last month.

The only reason the Carnegie experiment was stopped at 3,000,000 pounds per square inch, or 200,000 atmos-

NEW

INTRODUCTION TO VERTEBRATE ZOOLOGY

By WILLIAM HENRY ATWOOD

Head of the Department of Biology, Milwaukee State Teachers College

Throughout the selecting, assembling and writing of the materials of this textbook the possibilities of its use in three types of courses have been constantly kept in mind. 1. Primarily it is a text in vertebrate zoology, and as such may be used in a semester course devoted exclusively to that subject. 2. In general zoology courses where invertebrates are studied the first semester and the vertebrates the second semester this text should be valuable. 3. In vertebrate anatomy courses where two or three types are dissected, this text with the lectures should provide a valuable orientation of subject matter.

The core of the subject matter of this text is a combination of the classification and anatomy of the vertebrates reinforced by sufficient other zoological material to give it life. Coverage is as follows:

1. Introduction	20 pages
2. Classification	13 pages
3. The Chordates	40 pages
4. The Lower Craniates	32 pages
5. The Fishes	77 pages
6. The Amphibians	44 pages
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pheres, was that the pressure gauge used was not calibrated beyond that point. The pressure equipment itself potentially may be capable of doubling this pressure. If this can be done, it will produce a pressure equal to that inside the earth at depths of 745 miles and permit important studies of the properties of matter at these pressures.

Announcement of the Carnegie's new cascade bomb equipment was a dramatic highlight of the Conference on Theoretical Physics sponsored annually by the Carnegie Institution and George Washington University. Those present heartily applauded the new high-pressure achievement which was performed in an intensive all-night research by Dr. Goranson and Mr. Johnson. It was at this same conference, just a year ago, that the dramatic announcement was made to America that science had found a way to split uranium atoms with neutrons and make them yield enormous amounts of atomic energy. A friendly race between Harvard and the Carnegie Institution appears to be in progress to attain world's record high pressures.

The secret of the amazing pressures attained by the Carnegie experimenters is the use of cascade bomb apparatus. This device consists of two pressure chambers arranged one inside the other so that the inner one is surrounded with a kerosene-like oil known as varsol under a pressure of 17,000 atmospheres, or 255,000 pounds to the square inch.—ROBERT D. POTTER.

NEW TYPE RADIO SETS

(Copyright, 1940, by Science Service)

WITHIN a year new types of radio receivers for detecting the crystal clear frequency modulated (FM) radio transmission will be selling for \$33, was predicted by Major Edwin H. Armstrong, radio inventor and professor of electrical engineering at Columbia University, at hearings of the Federal Communications Commission in Washington. The present price of such receivers is \$65 but is based only on production of 1,000 receivers. Major Armstrong testified that the price can be cut in half with greater production, and that this reduction should come within a year.

Major Armstrong told the FCC that if these receivers were plugged into console radio-phonograph receivers now in use, through the jack for the phonograph record-playing, greatly superior performances could be achieved. The large-sized speaker in these console sets, he indicated, allowed present receivers to utilize the added tone brilliancy and fidelity possible with FM reception. A small-sized loud speaker, used with FM receivers, would permit some gain in performance but not very much.

Under examination before the FCC it was brought out that Major Armstrong has received \$755,000 from the sale of his three outstanding radio patents: the regenerative circuit, the super-heterodyne circuit and the super-regenerative circuit. All this money, he testified, he has poured back into the development of his new FM system.

It was disclosed that Major Armstrong receives no royalties from the manufacturers of FM transmitters but

only a lump sum payment which ranges from \$300 for a small 250-watt transmitter to \$5,000 for the largest power. If the transmitter manufacturer will promise to spend a sum for research on FM equal to this amount Major Armstrong waives his fees and receives nothing for licensing the transmitter manufacturer. The FCC commissioners carefully questioned Major Armstrong on his assertion that with FM radio and directive antennas it is possible to separate two stations broadcasting on the same frequency when the ratio of their signal strength is only two to one. In present type of broadcasting a signal ratio of 20 to one is needed for this feat.

Major Armstrong has received 15 patents, dating from December, 1933, on the new frequency modulated radio system, but he has studied it, off and on, for the last 20 years.—ROBERT D. POTTER.

OPTICAL TESTS FOR DETERMINING THE PRESENCE OF CANCER

(Copyright, 1940, by Science Service)

A NEW optical test that tells whether a person has cancer and whether after operation that cancer has been successfully treated is claimed by Dr. M. W. Mettenleiter, New York surgeon, connected with St. Clare's Hospital. In a preliminary series of 325 cancer cases, the test is reported to have proved 96 per cent. correct.

Developed from German studies reported over the last thirty years, the Mettenleiter test involves the measurement of the densities of a number of samples of the person's blood serum by use of an interferometer. The blood serum from the patient is mixed with an extract of human cancer cells from a patient known to have carcinoma of the breast.

Varying amounts of the suspected patient's blood serum are placed in four test-tubes containing equal amounts of the cancer extract. After incubation and settling, the densities of the four dilutions are obtained, and plotted out graphically. The curves are reported to show a characteristic difference between cancerous and the non-cancerous blood serum.

Dr. Mettenleiter believes that the test will prove of assistance in the early diagnosis of cancer and in determining the course of a case. He finds that a curve indicating cancer slowly changes to a normal curve after a successful operation. He reports that it changes again from a normal to a cancer curve in the earliest stages of recurrence. A cancer curve, it was found, does not change postoperatively if metastases or spreading of the cancer have already or are about to take place elsewhere in the body.

The test reaction failed to appear when serum of a pregnant woman or of a person with tuberculosis, syphilis or numerous other diseases was used, it was reported. However, as was to be expected, fever and intensive x-ray treatments influenced the serum so as to make the test uncertain. Extract of normal organs, for example, fibroid tissue, failed to show any reaction.

Dr. Mettenleiter made known his researches through a communication to the British science journal, *Nature*. He is a fellow of the American Medical Association and

of the American College of Surgeons. Born and educated in Germany, he has practised in New York since 1927.

A successful, practical test for cancer has been sought by many experimenters. About a score of such tests have been announced from time to time. The Mettenleiter test will undoubtedly be received with interest. Others working on cancer will try it and they must report success before it can be expected to come into use.—WATSON DAVIS.

CANCER AND SUNLIGHT

(Copyright, 1940, by Science Service)

PREVENTING cancer by sunlight may be possible if more can be learned about how the sun's rays affect the body. Evidence that exposure to sunlight does produce cancer immunity in some cases was presented by Dr. Frank L. Apperly, Medical College of Virginia, at the meeting in Pittsburgh of the American Association of Pathologists and Bacteriologists.

Cancer mortality in the United States and Canada grows less, Dr. Apperly finds, as the amount of sunlight increases across the continent and as more people are exposed to sunshine, for example, where more of the population is engaged in farming or other outdoor occupation.

Differing from some others who believe sunlight holds the key to cancer prevention, Dr. Apperly does not believe it is necessary to have skin cancer in order to become immune to other forms of cancer. Those who hold this view believe cancer deaths might be reduced by enough sunlight to cause skin cancer, which is easily cured, and which might leave the individual with immunity to other more killing forms of cancer.

Sun rays, or something closely associated with them, according to Dr. Apperly, have two separate effects: (1) They produce some sort of relative immunity to cancer in general and, in those localities where the mean temperature is less than about 42 degrees Fahrenheit, even to skin cancer; (2) at mean temperatures above 42 degrees Fahrenheit, sun rays produce more cancer on those parts of the skin exposed to them, in spite of a generally raised immunity.

Besides the statistics of cancer deaths in various climates, Dr. Apperly cited animal studies by other investigators which, though not completely applicable to humans, have a bearing on the question. When mice were given a large dose of x-rays before application of a cancer-causing coal tar chemical, methylcholanthrene, they died at almost three times the rate of animals not previously x-rayed. Small doses of x-rays before the chemical treatment, however, protected the mice against the cancerous effect of the chemical to such an extent that the cancer mortality was only one third that of the non-x-rayed group. "We may be able to reduce our cancer deaths," Dr. Apperly concluded, "by inducing a partial or complete immunity by exposure of suitable skin areas to sunlight or the proper artificial light rays of intensity and duration insufficient to produce an actual skin cancer. The study of the effects of sunlight on the living organism, and of those conditions in the skin which modify its action, may produce results of inestimable value."

ITEMS

THE report of papers presented at New Orleans before the Federation of American Experimental Biological Societies, printed last week, should have been signed Jane Stafford, medical staff writer of Science Service.

SPRING farm work has been delayed a full two weeks in many sections of the East and Central Valley regions, by continuing cold, wet weather, the U. S. Weather Bureau's weekly survey shows. At this time last year, farmers were troubled by an exactly opposite state of things: a persistent spring drought that even made itself severely felt in Florida. Dry weather, however, has prevailed in the nearer Southwest, from upland Arkansas to Texas, where corn planting has had to be postponed in many communities until rains come. Early cotton plantings show poor stands in Texas, and little is up at all in other parts of the western Cotton Belt. In eastern cotton states planting still awaits drier soil and warmer weather. The Plains area reports conditions ranging all the way from a severe dust storm in Oklahoma to unworkably wet fields in Montana. In general, Plains farms have adequate topsoil moisture at present.

THE extreme precision needed in modern airplane manufacture requires the use of rivets which have been kept chilled at the temperature of dry ice. At the works of the Boeing Aircraft Company, at Seattle, Washington, special heat treatment is given to aluminum alloy rivets. They are then placed in refrigerated boxes at dry ice temperature which retards their aging, or hardening, characteristics. As used they are removed from the boxes and quickly driven into place.

THE medical care and health service plan which this nation finally adopts will be that one of the various proposed plans which captures the public's imagination, according to the prediction of J. Douglas Colman, director of the Associated Hospital Service of Baltimore. The most obvious channel through which health services might flow is, of course, that of government, Mr. Colman said in a discussion of medical care at the Johns Hopkins School of Hygiene under the De Lamar Foundation. Other channels are private enterprise, the cooperative movement and local voluntary effort as exemplified "in our voluntary hospital system and more recently in Hospital Service Plans. Already there are indications of markedly increased activity in each of these fields. Probably each one of them will contribute in some measure to an ultimate solution and probably under each one of them a fairly workable program could be developed. Certainly the choice will be made by the public, and in terms of the one which can most capture its imagination. During 1940, the 56 non-profit hospital service plans approved by the American Hospital Association, he reported, will provide their 4,500,000 subscribers with approximately \$25,000,000 worth of hospital service. Subscribers to these plans have increased from about 50,000 in 1935 to the present 4,500,000.

THE SCIENTIFIC MONTHLY

J. McKEEN CATTELL, F. R. MOULTON and WARE CATTELL, Editors

CONTENTS FOR APRIL

- SCIENCE AND SOCIAL EFFECTS: THREE FAILURES. PRESIDENT ISAIAH BOWMAN.
 SEVENTY YEARS OF SUEZ. PROFESSOR W. O. BLANCHARD.
 MANAGEMENT OF AQUATIC WILDLIFE IN THE GREAT BASIN. PROFESSOR ANGUS M. WOODBURY.
 DEVELOPMENT AND MANUFACTURE OF OPTICAL GLASS IN AMERICA. M. HERBERT EISENHART AND EVERETT W. MELSON.
 ANALYSIS OF WORLD'S FAIRS' HEARING TESTS. H. C. MONTGOMERY.
 ORGANISM, SOCIETY AND SCIENCE. I. PROFESSOR R. W. GERARD.
 MUSICAL INHERITANCE. PROFESSOR CARL E. SEASHORE.
 THE "CHAIR" FOR INSECTS? DR. ROBERT C. MURPHY.
 "MIND IS MINDING," BUT OR STILL. But, PROFESSOR JARED S. MOORE; Still, PROFESSOR LESLIE A. WHITE.
 BOOKS ON SCIENCE FOR LAYMEN:
Children's Science Books Published in 1939; Photographing the Invisible; The Life of the Mind; The Rise of Civilization.
 THE PROGRESS OF SCIENCE:
Centenary Celebration of the Wilkes Exploring Expedition; National Zoological Park Expedition to Liberia; Importance of Grassland Reserves; Endocrine Glands and Their Disorders; Dispelling Fog; Average Use of Mechanical Power.

CONTENTS FOR FEBRUARY

- GEOLOGY AND CLIMATOLOGY FROM THE OCEAN ABYSS. DR. WILMOT H. BRADLEY.
 WILLIAM BARTON ROGERS, PIONEER AMERICAN SCIENTIST. DR. ARTHUR BEVAN.
 NATURALISTS IN THE WILDS OF BRITISH COLUMBIA. II. JOHN F. AND THEODORA C. STANWELL-FLETCHER.
 "THE APOTHEOSIS OF SCIENCE." ROBERT LOVELL BLACK.
 COOPERATION IN ASTRONOMY. DR. OTTO STRUVE.
 WHY WE EAT WHAT WE EAT. DR. WARREN T. VAUGHAN.
 VIEWS ON MACHINERY AND UNEMPLOYMENT. PROFESSOR C. E. DANKERT.
 TELEPATHY—A SURVEY. PROFESSOR SUMNER BOYER ELY.
 STUDIES IN MOSQUITO BEHAVIOR. DR. JOHN A. MILLER.
 BOOKS ON SCIENCE FOR LAYMEN:
Can the Disabled Exercise?; A Catalogue of Poisonous Plants; Tribute to a Scientific Leader; Drama Among Fossils.
 THE PROGRESS OF SCIENCE:
The American Association for the Advancement of Science; The Columbus Meeting in Retrospect; Newly Elected President; Award of the One Thousand Dollar Prize; Symposium on Blood, Heart and Circulation; The Scientific Exhibition; Washington Dinner in Honor of Julian S. Huxley.

CONTENTS FOR MARCH

- THE FUTURE OF MAN AS AN INHABITANT OF THE EARTH. PROFESSOR KIRTLEY F. MATHER.
 THE ROLE OF CHANCE IN DISCOVERY. PROFESSOR W. B. CANNON.
 NATURALISTS IN THE WILDS OF BRITISH COLUMBIA. III. JOHN F. AND THEODORA C. STANWELL-FLETCHER.
 TWENTY-FIVE YEARS' QUEST OF THE WHALE SHARK. DR. E. W. GUDGER.
 SOME GEOGRAPHIC ASPECTS OF THE MANUFACTURE OF MEZCAL. DR. RAYMOND E. CRIST.
 EXPLORING THE CHEMICAL CAUSES OF CANCER. DR. GRAY H. TWOMBLY.
 THE SPACE IN WHICH WE LIVE. DR. PAUL R. HEYL.
 SCIENCE IN AN UNFRIENDLY WORLD. DR. W. JAMES LYONS.
 THE SOCIAL SIGNIFICANCE OF SCIENCE. HENRY M. WRISTON.
 MEDICINE IN THE BIBLE. DR. CHARLES WEISS.
 BOOKS ON SCIENCE FOR LAYMEN:
Some Pioneer Psychologists; From the Dawn of Surgery; To Find a Snake; In the Tidal Zones; A Nation-Wide Institution.
 THE PROGRESS OF SCIENCE:
The Nobel Prize Award in Physics for 1939 to E. O. Lawrence; The Centenary of the Discovery of the Vulcanization of Rubber; Opening of the Buhl Planetarium and Institute of Popular Science in Pittsburgh; More Speed in Camera Lenses; House-Heating by Solar Energy.

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SCIENCE NEWS

Science Service, Washington, D. C.

THE RECENT MAGNETIC STORM

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A TERRIFIC disturbance on the sun was the cause of the worst magnetic disturbance in years which blacked-out telegraph lines, disturbed radio communication, and interfered with long distance telephony on Easter Sunday. Unusual radiation from the sun swept down upon the earth, setting up vast currents of electricity in the upper atmospheric layers, 60 to 90 miles above the earth, and shooting electrical currents through the earth to mix up or make inoperable communication lines, especially those that use the earth as one side of the circuit.

Not until scientists have been able to inspect and study automatic records made at various magnetic, radio, astronomical and other laboratories will the full extent of this Easter magnetic storm be known accurately. However, preliminary studies show that it was more severe than the famous storm of 1938 which occurred on Easter Saturday, April 16. In that storm a telegraph station in Oslo was set on fire by the current generated in its wire circuits, and telephone bells rang without anyone calling.

During the 1938 disturbance—when Northern Lights were seen as far south as the north coast of Africa, and France had a one-night fear that the glow in the sky was the start of a war—the electrical currents in the atmosphere of the earth amounted to several million amperes. The current magnetic storm is believed to have been even more severe, and probably is the worst since that of May, 1921.

The most famous magnetic storm on record is that of 1859, when so much electricity was generated in telegraph lines that batteries were no longer needed to operate instruments. The natural electricity was, in fact, used to operate telegraph tickers.

A large sunspot group visible to the naked eye properly protected by smoked glass, was in its best observing position on Sunday, but three previous appearances of the same group had brought no magnetic effects. Evidently the solar disturbance was a gigantic flare-up rather than just a sunspot. Significance in the coming of this storm close to the time of the spring equinox is seen by some, due to the sun and earth being lined up at that time.

Magnetic instruments of the U. S. Coast and Geodetic Survey's magnetic station at Cheltenham, Md., showed that the current magnetic storm was extremely intense. At the magnetic observatory at Tucson, Ariz., the recording instruments went off the record, so violent was the magnetic disturbance. It is believed that perhaps the only complete record of the magnetic disturbance will come from the magnetic observatory of Carnegie Institution at Huancayo, Peru, where a specially-built insensitive instrument is installed for just such occasions.

The magnetic storm was world-wide in extent. It began at 8:49 A.M., E.S.T. on Easter Sunday and was still in progress 24 hours later. The horizontal intensity of the earth's magnetic field at the height of the disturbance

was over 1,000 gammas, compared with a range of only 50 gammas on an ordinary day. A range of 200 gammas is considered a magnetic storm, according to Dr. A. K. Ludy, of the U. S. Coast and Geodetic Survey. A gamma is a unit of magnetic intensity. It appears that electrical circuits suffered disrupted service to a large degree during the storm. The storm of 1938 appeared, in contrast, to affect radio communication more than it did wire circuits.

It is explained, however, that the seriousness of a magnetic storm, from the standpoint of disrupted communications is not a complete index of its intensity. All magnetic storms are world-wide in scope, but regions are found where the intensity is a bit greater than the average. If these maxima happen to occur in a region (like the Northern Hemisphere) where wires and radio are widely used, the magnetic storm may produce a serious communications blockade. If the maxima come in a sparsely settled region the world worries little about it.

The situation is quite like that for earthquakes which arouse little interest if they occur in remote parts of the world away from civilized centers where they can cause life or property damage.—WATSON DAVIS.

VIRUSES THOUGHT TO HOLD SECRET OF LIFE'S ORIGIN BUT DISCOVERY OF TRANSITION POINT BETWEEN LIVING AND NON-LIVING WILL BE DIFFICULT

(Copyright, 1940, by Science Service)

VIRUSES, best known as causing diseases like infantile paralysis and influenza, may some day reveal the secret of the origin of life. Discovery of the exact transition point between living and non-living, however, even if it can be made through virus studies, will be difficult, Dr. Thomas M. Rivers, director of the Hospital of the Rockefeller Institute for Medical Research and an authority on viruses, stated at a recent meeting of the New York Academy of Medicine.

When bacteria, slightly larger disease-causers, were discovered, Dr. Rivers pointed out, it was thought that these tiny organisms were the key to the origin of life in the world in general. Now some scientists believe that this is the case for viruses.

"At present there are a number of ideas regarding the nature of viruses," Dr. Rivers said. "According to one, viruses represent the results of retrograde evolution that might have proceeded to the point of a single living molecule; to another, they are examples of how life begins; to still another, they are autocatalytic agents, that is agents, presumably without life, which in some unknown manner are capable of inciting the production of more of themselves through the building up, breaking down, or rearrangement of materials or molecules in their host cells; finally, they are transitional forms between the living and the non-living.

"There is one objection to all these ideas, namely, each

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stresses the point that all viruses must be similar in nature. However, to me it appears not unlikely that if the concepts set forth by the different workers are within the realm of possibility more than one of them may hold within the virus group, and that viruses are not necessarily all alike in nature.

"In other words, I am of the opinion that some of the viruses may be minute, highly parasitic microorganisms, the midgets of the microbial world, capable of reproduction only within susceptible host cells; that others may represent forms of life more or less unfamiliar to us; and that still others may be fabrications of their host cells aided by the processes of autocatalysis.

"What life is and where the transition from the non-living to the living takes place, if it does, in the scheme just set forth is not known. Indeed, the transition may be so gradual that it will be difficult for investigators to determine the particular point at which it occurs."

THE INDUSTRIAL USES OF CORN

(Copyright, 1940, by Science Service)

RESEARCH to find industrial uses for corn will have to go clear down to details of molecular structure of the starch, proteins and other constituents of the corn grain, according to a statement made by Dr. Henry G. Knight, chief of the bureau of agricultural chemistry and engineering, U. S. Department of Agriculture, in an address given before the Sixth Annual National Farm Chemurgic Conference at Chicago. Dr. Knight outlined to his audience some of the lines of attack contemplated in the research program for the Northern Regional Laboratory, now building at Peoria, Ill.

Dr. Knight's figures indicated that corn, the country's biggest single crop, has an apparently inevitable flow toward food. Only 9 per cent. of the crop leaves the farm for the hoppers of industrial plants. Of this, about a fourth goes right back to the farm as feed for animals, and another half becomes human food in one form or another. In other words, the actual percentage of the total corn crop that enters non-food uses is very small.

Starch, which makes up the bulk of the corn grain, also makes up the bulk of corn's present industrial output. By far the greater part is used as starch or after conversion into compounds of smaller molecular size, the most familiar of which are glucose and alcohol. Practically nothing has been done in the direction of building the molecules up into bigger ones, as molecules of starch's kin-compound, cellulose, have been built up into such products as rayon, synthetic plastics, transparent wrapping sheets, and so on. Exploration of such possibilities for starch is to be an important part of the work of the new Northern Regional Laboratory.

Another corn product having possibilities in industrial build-ups is corn oil. At present, practically all corn oil is used in food. But if larger industrial uses are found for corn starch and its products, correspondingly more corn oil will become available, for which it will be desirable to find non-food uses if possible.

One important group of compounds in corn oil consists of linoleic acid glycerides, which may be adapted to molecular build-up techniques, Dr. Knight pointed out. He

added, "The use of this component of corn oil in surface coatings, rubber-like structural materials, flotation agents, adhesives, sprays, lubricants, and lubricant addition agents, etc., on a large scale is not an unreasonable expectation."

Corn proteins, left over after industrial processing, now go mainly into feedstuffs, and are used to some extent indirectly in human foods. Industrial uses for them represent a practically unexplored field.

Industrial and power alcohol is not now being successfully manufactured from corn, due largely to the price competition of cheaper materials. However, a program of research into all possible angles of the power alcohol field, more basic and comprehensive than anything hitherto attempted, is planned for the new Regional Laboratory.

A NEW ALLOY OF MANGANESE AND COPPER

(Copyright, 1940, by Science Service)

AN alloy as strong as steel, but as noiseless and as free from "chatter" as rubber, is only one of the series of new metals being evolved in the manganese experiments of the U. S. Bureau of Mines, according to Dr. R. S. Dean, chief engineer of the metallurgical division of the Bureau.

In a demonstration before the Colorado Mining Association, Dr. Dean dropped a piece of brass and a piece of steel on the floor with a clang. Then he dropped a piece of the new alloy. There was a slight thump but no ring or clang whatever—much the same as if a piece of hard rubber had been dropped.

The new alloy is of manganese and copper properly heat-treated, "It dampens or absorbs vibrations like rubber or good cardboard, which convert noise into heat." "The silent properties of rubber are sought after, but there are many places in industry where it can not be used. Generally speaking, rubber substances are unusable in tension—rubber axles or drive shafts are hardly feasible. Here we have an alloy with the strength and modulus of elasticity of mild steel, that has the noise-absorbing properties of rubber. This opens up many new possibilities; chatterless spring suspensions, noiseless gears, a muffler for a whole host of bothersome industrial sounds. This alloy is being tried for those uses now."

The new manganese-copper alloys are made possible by the reduction of manganese by electrolysis, which permits metal 99.96 per cent. pure to be made, as against 96 or 97 per cent. purity by older methods. The less pure manganese is used mostly for alloying with iron.

An alloy of the new purer manganese, with 2 per cent. copper and 1 per cent. nickel, resembles copper in ductility and other qualities, but by heat treatment it can be given an electrical resistance 1,000 times that of copper.

Another manganese-copper-nickel alloy has a tremendous hardening range, from that of copper to that of die steel, Dr. Dean said. This hardening can be so controlled that the interior of a tool or casting can be as soft as copper while the surface is hardened like that of steel.

Still another property of some of the new manganese alloys is low heat conductivity. This opens vistas of pot-handles and holders made of metal but which stay as cool as wooden handles.

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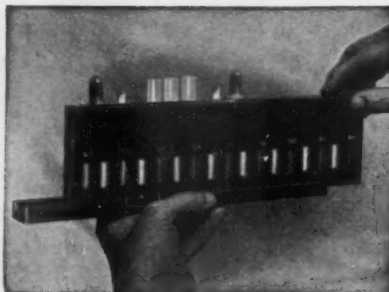
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A NEW TYPE OF VACUUM TUBE

A NEW type of vacuum tube for amplifying and repeating weak electrical messages that carry long-distance telephone communication has been developed at the Bell Telephone Laboratories. It is confidently expected to give many years of continuous 24-hour-a-day service.

The present telephone tube, which the new advance replaces, has a theoretical average lifetime of 18,000 hours. The new tube will exceed this several times, scientists report.

Best comparison of the new and the old is that after 22,000 hours of service (two and a half years) only 55 per cent. of the old style tubes were in service. With the new tubes 95 per cent. were in service after the same interval of time. From comparison of the "death" curves of the two vacuum tubes telephone engineers estimate, conservatively, an average lifetime several times longer for the new tubes than for the old.

For the layman, whose nearest contact with vacuum tubes is probably in his radio set, this new advance will probably be a worry for he knows that his radio tubes are guaranteed only for a life of 1,000 hours of operation. The worry will be the same type of difficulty which arose last year when Dr. F. B. Jewett, vice-president of the American Telephone and Telegraph Company, was vigorously questioned at the Monopoly Committee hearings in Washington about other telephone repeater tubes having a life of 50,000 hours.

It was disclosed then that the principles which give long life to telephone tubes can be applied to the tubes used in radio sets, but that high cost would probably rule them out. Moreover, excessive long life of such tubes, which is the key demand on telephone circuits, would permit them to outlast the rest of a common radio set many times. It would be like putting jewel bearings in a dollar alarm clock.

The extra long life of telephone repeater tubes comes about because of the extreme care in their production, plus a most rigid test, prior to use, which eliminates many tubes which might quickly show failure in service.

ITEMS

A "STRONG" submarine earthquake shock occurred off the western end of the Aleutian island chain, according to the U. S. Coast and Geodetic Survey where the epicenter has been calculated from information relayed by Science Service from seismological observatories. The earthquake occurred on March 27 at 7:31 A.M. Eastern Standard Time. The epicenter was 52 degrees north latitude and 176 degrees east longitude. Seismological stations reporting the shock included: Fordham University; Georgetown University; Pennsylvania State College; Ottawa; Bozeman, Mont.; Sitka, Alaska, and Honolulu.

THERE was nothing "unusual" about the Easter cold wave, according to the U. S. Weather Bureau. It was a perfectly normal mass of chill air, moving down the map from Alaska and points northwest. The only thing out of the ordinary was that it was a little larger than average, and later than a chill of similar intensity has been for a number of years. Also, of course, Easter was considerably in advance of the usual date.

A PRODUCTION tax of nearly 4 per cent. was levied last year on the corn crop of the northeastern states, by one insect pest, the European corn borer, according to estimates of the U. S. Department of Agriculture. Value of the field and sweet corn crops in the corn borer's range last year was approximately \$106,000,000; borer damage amounted to \$4,000,000. This is nearly twice the estimated damage for the 1938 corn season. The European corn borer's range is still confined mainly to the states east of the Mississippi and north of the Ohio. For some reason the insect has been slow in invading the great corn areas of the prairie states.

FIVE great stone heads, each weighing more than 20 tons, are the newest ancient American mystery. Unearthed in Mexico by a joint expedition of the National Geographic Society and the Smithsonian Institution, four of the mammoth carved heads are reported as having broad noses, thick lips and prominent eyes. How Indians transported such heavy basalt boulders, six to eight feet high, to the swampy plain near La Venta, in the state of Tabasco, is not yet understood. Nearest basalt found by the archaeologists is 100 miles away. The age and the significance of the stone heads are other unsolved mysteries.

HIGH-PITCHED noises have a greater depressing effect than lower-pitched ones of the same degree of loudness, according to Drs. Edward J. Van Liere, Paul E. Vaughan and Davis W. Northup, West Virginia University School of Medicine. At a high pitch, a noise about as loud as a riveter slows down secretion of digestive juices and acid in the stomach more than the same noise at a low pitch. The same studies showed that variation between individuals is important, some being able to stand the same amount of noise better than others. The work was described at the New Orleans meetings of biologists.

GLASS real-looking flowers were placed on exhibit in a first-day-of-spring exhibit at the Hayden Planetarium, New York, beginning on March 20, at 1:24 P.M., EST, when the sun crossed the equator and spring officially opened. The flowers were made by the late H. O. Mueller and his son, Herman Mueller, who is now glassblower at the American Museum of Natural History, for Mrs. S. Stanwood Menken, and later presented to the Museum by her son, Arthur B. Menken. They represent, in lifelike color and fine details of structure, such springtime favorites as violets, crocus, narcissus, laurel and rhododendron.

MENINGITIS cases in England and Wales have increased since the war began to a number greater than the previous record high reported in 1915. "Epidemiologists who studied the behavior of outbreaks during the last war are not surprised that the prevalence of the disease has been unusually great and are apprehensive of a considerable epidemic in the near future," according to the editor of the *Lancet*. Meningitis is essentially a disease of recruits, that is, of newcomers to community life who have not had time to become adapted to or latently immunized by the germs in their new environment. War mobilization, and the black-out and bitter winter weather which interfered with proper ventilation are blamed for the present alarming increase in cases.

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SCIENCE NEWS

*Science Service, Washington, D. C.*THE SESQUICENTENNIAL CELEBRATION
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THE nation is now celebrating the anniversary of an event that has grown steadily in importance down through the succeeding decades.

On April 10 in 1790 President George Washington approved the first United States patent law. With the enactment of that statute which, by the way, he had urged as a help to inventors, our present patent system had its beginning.

That system, in turn, has spurred our advancement and not only has promoted our industrial welfare, but has also brought us social and political benefits great in number and significance. It has faithfully and fruitfully served the democracy that begot it.

There were inventors, of course, before 1790, and man's inventiveness long preceded our patent system. Down through the ages his ingenuity produced many useful contrivances. But for these there was no reward but their makers' sense of achievement. There was no material return, no protection; scarcely was there renown for the creators of these new mechanisms and methods.

Gunpowder has been for centuries both a beneficent and a baneful influence in the world, but the true identity of its discovery is hotly disputed.

The American patent system has encouraged the use of good means to worthy ends. It has succeeded in profiting the whole nation by safeguarding and recompensing the individual. It has fulfilled the purpose which the authors of our Constitution had in view when they empowered Congress "To promote the progress of science and useful arts by securing . . . to inventors the exclusive rights to . . . their discoveries."

We owe to that incentive, I believe, the invention of the cotton gin only four years after the passage of the first patent law. As this stimulus became more widely known through the inventions it fostered and recognized, it prompted more and greater efforts and accomplishments.

Within a little more than fifty years after President Washington's approval of the law of 1790 came the telegraph, the reaper, the vulcanization of rubber, the revolver, the sewing machine and the rotary printing press.

In the 104 years since the revision and refinement of the patent system in 1836, there have been granted 2,196,000 patents to many thousands of individuals, the vast majority of them citizens of the United States. Only 9,957 patents were issued before July, 1836.

Many of the inventions covered by these 2,196,000 patents supply our needs and serve our convenience every hour of every day. Such marvels as the telephone, the incandescent electric lamp, the phonograph, motion pictures, the submarine, the linotype, the airplane and the radio, including television, are covered by patents granted in the last 65 years, that is, since the birth of six or seven millions of Americans still alive.

In the first century following the establishment of our patent system 405,262 patents were issued. More than four times that number, that is to say, 1,799,000, have been granted in the last fifty years alone. And it will be conceded, I think, that the inventions patented in the last five decades are no less important than any that went before.

The use of these inventions presupposes their production, distribution and operation. To make and merchandise them requires the investment of capital and the employment of labor. Many of our greatest industries are founded on inventions. It is reasonable to believe that without these inventions we should not have the industries they created.

The word invention means to many people simply a machine that reduces or wholly displaces manpower and by that reduction and displacement raises economic problems and difficulties.

This subject is too big for complete discussion here, but I can give a generalization. We are not yet blessed—or cursed—with machines that make themselves. Those now in service had to be constructed of raw materials which had to be produced and transported and fashioned to requirements. All of these processes necessitated human effort.

In short, man is prior and indispensable to the machine. You can have man without a machine, but you can never have a machine without man.

The moral which this anniversary impresses on me is that patents have put a premium on genius, and all of us have shared the gains. Every successful invention becomes a new inspiration. While that impetus continues we may count on progressive improvement in our way of life.—CONWAY P. COE, *Commissioner of Patents.*

GERM-KILLING CHEMICALS

(Copyright, 1940, by Science Service)

DR. RENÉ J. DUBOS, of the Hospital of the Rockefeller Institute for Medical Research, predicted at the meeting in Cleveland of the American College of Physicians that chemical curing of disease, widely practised since the discovery of sulfanilamide, can develop along rational and presumably more effective lines as a result of discovery of the most powerful known germ-killing chemicals, substances produced by bacteria that live in the soil.

For his discovery of potent germ-killers produced by soil bacteria, Dr. Dubos received at this meeting the John Phillips Memorial Award of the College.

The new germ-killing chemicals can protect mice against pneumonia and against streptococcus infection, but it may be many years before they are ready for use in treating human patients. In the test-tube, the soil bacteria chemicals can kill pneumonia germs, streptococci, staphylococci, diphtheria bacilli and numerous other dangerous germs. One of the chemicals, gramacidin, is so powerful that less than one grain of it (0.002 milligrams) can protect a mouse against 10,000 fatal doses of pneumonia germs or streptococci.

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While the soil bacteria chemicals are potent killers of one class of germs, called Gram positive, they are less effective against the Gram negative class of germs to which belong the gonococci and meningococci. For dealing with the general problem of antiseptics, it is important that the differences between these two classes of germs which make them respond differently to Gram's stain and to the new chemicals should be understood. Meanwhile, chemical studies now in progress of the structure of the new germ-killers from soil bacteria may "suggest new lines of investigation for the development of chemotherapy on a rational basis."—JANE STAFFORD.

A NEW B VITAMIN AND PERNICIOUS ANEMIA

(Copyright, 1940, by Science Service)

At the Cleveland meeting of the American College of Physicians it was stated that investigators are on the trail of a new B vitamin, an unknown substance in yeast which cures pernicious anemia in some cases.

Uses of the new, still unidentified B vitamin came out at a clinic on pernicious anemia held at the Cleveland Clinic. Discovery of the new substance was made by Drs. M. M. Wintrobe and Arnold R. Rich, of the Johns Hopkins University, who experimented with swine. The fact that yeast extract will cure some cases of pernicious anemia in man was mentioned by Dr. C. P. Rhoads, of Memorial Hospital, New York City, although he emphasized that he was not responsible for its discovery.

Pernicious anemia, it was explained, is due to lack of a dietary factor plus lack of a substance present in normal stomachs. Neither of these alone cures the disease, but the combination, found in liver, does. If the anemia is due only to lack of the diet factor, as in some cases of the tropical disease, sprue, the unknown substance in yeast will effect a cure. Investigations are being made to determine what this anemia-curing substance, chemically unlike other parts of the B vitamin, is.

The dangers and benefits of sulfamethylthiazole, the new chemical remedy related to sulfanilamide, and other new chemical remedies including synthetic sex hormones and the new epilepsy drug, dilatin, were discussed.

Sulfamethylthiazole appears to be easier on the kidneys than sulfapyridine, the older pneumonia remedy, but is reported to have caused some cases of multiple neurosis. This is a drawback but not a catastrophe, Dr. M. A. Blankenhorn, of Cincinnati, said, since the neuritis can be cured by vitamin B. He said that the new drug had been used in about 50 cases at his hospital without any neuritis developing. The new remedy, however, has not yet been released for general use by the federal food and drug authorities.—JANE STAFFORD.

THE VITAMIN CONTENT OF GRASS

(Copyright, 1940, by Science Service)

SCIENTISTS have discovered how to put the rich vitamin content of grass into palatable foods for man, according to a report made at the Cincinnati meeting of the American Chemical Society.

W. R. Graham, G. O. Kohler and C. F. Schnabel, of the American Butter Company, Kansas City, Mo., who per-

formed the experiments, said that their work was "the first successful scientific effort to transmit the unique properties of grass directly into human nutrition."

The vitamin content of grass leaves is much greater than the vitamin content of the four standard classes into which fruits and vegetables are divided. Grass leaves, known as cerophyl, on an equal weight basis contain 280,000 international units of vitamin A, whereas potatoes and sweet potatoes contain only 1,000 units. By the same rating tomatoes and citrus fruits contain only 2,000 units; leafy, green and yellow vegetables 12,000 units. Other fruits and vegetables contain 1,290 units on the same scale. In crucial vitamin B₁ content, grasses contain 1,300 international units, about ten times the amount obtainable from any other vegetables and fruits.

"These new grass products," the report continued, "recommend themselves as food constituents not only because of their wealth in supplying the better known vitamins but because animal assays have shown vitamin A, B, C, E, G, K, nicotinic acid, grass juice factor, B₆, B₁₂, R, U, and Factor W to be present in significant quantities. Recent experiments have shown that the processed product contains sufficient vitamins both known and unknown to support the normal rapid growth of laboratory animals when fed only cerophyl and water."—ROBERT D. POTTER.

THE GERM-KILLING EFFECTIVENESS OF SULFANILAMIDE

(Copyright, 1940, by Science Service)

MEDICAL chemists are now matching their ingenuity against human blood. Their goal is the creation of a new type of sulfanilamide compound with double effectiveness against the germs which cause pneumonia and deadly streptococcus infections.

Drs. Ralph R. Mellon and L. E. Shinn, of the Institute of Pathology, Western Pennsylvania Hospital, Pittsburgh, told members of the American Chemical Society how the human blood has so far circumvented their efforts to increase the germ-killing effectiveness of their double-acting sulfanilamide drug.

They have the compound and know its structure. Current research is being directed toward stabilizing it, so that the patient's blood will not change its composition before it can attack the deadly germs.

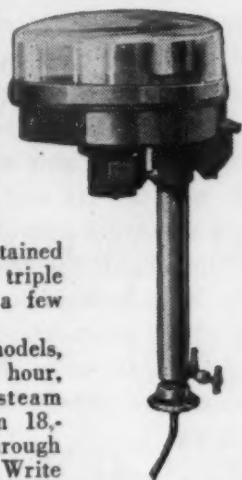
It was Dr. Mellon and his research colleagues who advanced the theory which probably explains how sulfanilamide works in the human body. Experiments have shown that sulfanilamide destroys disease germs by letting them kill themselves with the hydrogen peroxide they themselves create. Ordinary living material contains catalase, a substance which has the job of destroying hydrogen peroxide as it is formed in the cells of the human body during growth. It is believed that sulfanilamide destroys catalase in the germ cells, allows them to build up an excess of germicidal hydrogen peroxide and kill themselves. Sulfanilamide is thought to be broken down by the germs into an anti-catalase and the search has been made for this new chemical. Such a substance has been found by Drs. Mellon and Shinn, but it has been discovered too that the human blood quickly breaks it down so that it can not effectively reach the germs.

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Drs. Mellon and Shinn reported that they had changed the location of one of the chemical units in the complex sulfanilamide molecule and "preformed" it as the germs themselves might do. They left intact the part which the organisms convert into the anti-catalase and, at the same time, moved the new preformed part of the molecule so that much greater stability against the human blood is obtained.

So far the results have been only partially successful in this attempt to make a stable "preformed" anti-catalase, but the report states that "These findings . . . lead to the hope that it may be possible to produce prechanged sulfonamide drugs capable of reaching the infecting bacteria."—ROBERT D. POTTER.

THE MALARIA-CARRYING MOSQUITO IN BRAZIL

DR. RAYMOND B. FOSDICK, president of the Rockefeller Foundation, in his annual report, announced that a determined defense against a foreign invader, malaria-spreading gambiae mosquitoes, more to be feared than yellow fever, is being waged in Brazil with American support.

This African insect, first discovered in South America in 1930, now infests 12,000 square miles of territory. It is said to threaten all American countries, the United States included, with a catastrophe in comparison with which ordinary pestilence, conflagration and war would be but small and temporary calamities. Even penetration of yellow fever into the Orient might be a lesser evil.

The malaria-carrying mosquito was pushed back in 1939, although some 114,000 people were treated for the disease. Two thousand doctors, technicians, scouts, inspectors, guards and laborers were used in the campaign. The mosquitoes were pushed back to their central strongholds in the main river valleys and on the narrow coastal shelf. If held there during the coming rainy season, eventual eradication of the mosquitoes from the whole region may be attempted.

"The plans of the campaign against gambiae sound like the plans of an army on defense," Dr. Fosdick explained. "The frontiers of the infested region are defined by fumigation posts on all the outgoing roads. These are the forts of this new kind of Maginot Line.

"A 10-mile zone beyond the gambiae's limit of advance is to be kept non-infectible, which from the mosquito's point of view is the 'scorched earth' policy. Within this zone, as well as within the area already infected, all breeding places of the mosquito must be eliminated or treated with Paris green or other larvicide.

"The whole area is being mapped from the air so that no pools, ponds or other collections of water will be overlooked. The adult mosquitoes are being sought and killed in the houses with insecticide sprays to diminish the chances of their laying eggs and thus perpetuating the species in the region.

"Every automobile and train that leaves the infested area is being stopped, inspected and fumigated. A maritime service has been organized at points along the coast to disinfect every boat or plane bound for clean ports.

"It is war in a very real and grim sense, and, unlike

other types of war, its purpose is the preservation of human life."

ITEMS

A NEW spray for killing insects, extracted from leaves of the castor bean plant, was described at a meeting in Washington of the Agricultural Chemical Association by Dr. Richard Holzcker, chemist for the Woburn Degreasing Company of New Jersey. The new insecticide is claimed to be highly effective against all kinds of insect pests, operating both as contact and stomach poison. The spray has been used in large-scale experiments, principally in Florida, for the protection of garden truck and citrus fruits. Dr. Holzcker stated that fewer sprayings were needed with the new material than with commercial sprays now in use. He said also that the castor-leaf spray appears to have a stimulating effect on the trees, hastening the ripening of the fruit. Leaves of the castor bean plant have long been known to be poisonous. They contain one of the most extremely toxic of all known compounds, said to be far more deadly than cobra venom. Hitherto, however, no attempt has been made to put it to any practical use.

DR. S. I. FRANKEL, of St. Louis, working at the State Hospital for Epileptics, Parsons, Kans., reports in the *Journal of the American Medical Association* that by use of the drug dilantin sodium, the convulsions in epilepsy are prevented and the personality of the patient treated is remarkably improved. Of 48 patients treated 39 per cent. showed entire control of the convulsions, another 39 per cent. showed little or no benefit, while 21 per cent. showed definite alleviation.

BABIES born prematurely are less able to absorb fat than their full-term brothers and sisters, and should therefore be given a "leaner mixture" in feeding, was the advice of Dr. Harry H. Gordon, of the Children's Bureau, U. S. Department of Labor, and Helen McNamara, of Cornell University Medical College. They found that a diet based on half-skimmed milk could be handled by the stomachs of prematurely born babies with more satisfactory results than one built on whole milk, with undiminished cream content.

NEW disinfectant treatments for ridding imported hides of the virus of dangerous hoof-and-mouth disease, developed in joint research by investigators of the U. S. Department of Agriculture and the University of Cincinnati, have been officially approved for use by the Bureau of Animal Industry. Because of their greater effectiveness and lower cost, it is expected that they will be widely employed. The new treatments consist of immersing the hides for 24 hours or more in a 1-to-10,000 solution of sodium bifluoride, or in a 1-to-7500 solution of sodium silicofluoride. The disinfectant treatments hitherto in use have depended mainly on corrosive sublimate, which is many times more expensive, and also has a deleterious effect on the hides. The research work was done by Dr. Adolph Eichorn, director of the Animal Disease Station of the Bureau of Animal Industry, situated at Beltsville, Md., and by Dr. Fred O'Flaherty, director, and E. E. Doherty, bacteriologist, of the leather research laboratory maintained at the University of Cincinnati by the Tanners' Council of America.

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SCIENCE NEWS

Science Service, Washington, D. C.

COSMIC RAYS

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THE purpose of our cosmic ray studies just completed in India was to get as accurate measurements as possible of the total cosmic-ray energy which gets into the earth at a series of relatively closely spaced latitudes. We have only relatively recently perfected the technique of making these measurements through sending sounding balloons with recording instruments essentially to the top of the atmosphere, and this made it imperative to measure these energies as a function of latitude, and that for the following reason:

Every one knows that the earth is a great magnet with its poles near the north and south geographic poles, their distance apart being, therefore, about 8,000 miles. This means that the earth's magnetic field stretches fairly far out into space, so that it should be easily detectable, say, 20,000 miles above the earth's surface. In this respect it contrasts sharply with the atmosphere, which may be likened to a thin skin, say, 100 miles thick, hugging closely to the surface of the earth.

Cosmic ray electrons in trying to push their way through this magnetic field experience a blocking effect, so that at a given latitude it requires an energy of the incoming cosmic ray particles of a definite and computable amount to get through normally and strike the earth's surface at all. By measuring, then, the amount of energy that actually gets through, say, at the magnetic equator, where it takes 17 billion electron volts to get through vertically, and at, say, Agra, where it takes $14\frac{1}{2}$ billion volts to get through, we can find just how many electrons are shooting through space and trying to get through with energies in the range between $14\frac{1}{2}$ billion and 17 billion volts.

In other words, by measuring the total amount of cosmic ray energy coming into the earth at a series of latitudes, say, ten degrees apart in going from the equator to the pole, we can determine just what is the distribution of energy among the superpower particles that are plunging through the heavens.

The importance of knowing this if we want to know how the cosmic rays are formed needs no argument. We went to India with very considerable equipment, then, for the sake of finding through balloon flights just how much energy comes in at the equator, how much at Agra in the central part of India, and how much at Peshawar in the northern part of India. It will take us some time to work up the results, and we are at present not concerned whether they support particular conceptions as to the origin of cosmic rays, or not. They must in any case give us either negative or positive evidence with reference to any particular conception.

We made, all told, some 45 flights in collaboration with the Indian Meteorological Service, spending about a month in Agra in central India, eight days in Peshawar right under the Khyber Pass, the northernmost point in India, and nearly a month at Bangalore in south India

close to the magnetic equator. We had most extraordinary cooperation from the British Indian Meteorological Service, which generously supplied us with all the hydrogen needed and much assistance in these observations.

We shall not know what precise conclusions to draw from these observations until we have worked up our data, which will take some time; but we are sure that we got the data that we went to India to secure, and it is just as significant whether the answer is positive or negative with respect to any particular conception. It is just as important to eliminate this theory or that as it is to support that theory or this.—ROBERT A. MILLIKAN.

THE NEW CYCLOTRON OF THE UNIVERSITY OF CALIFORNIA

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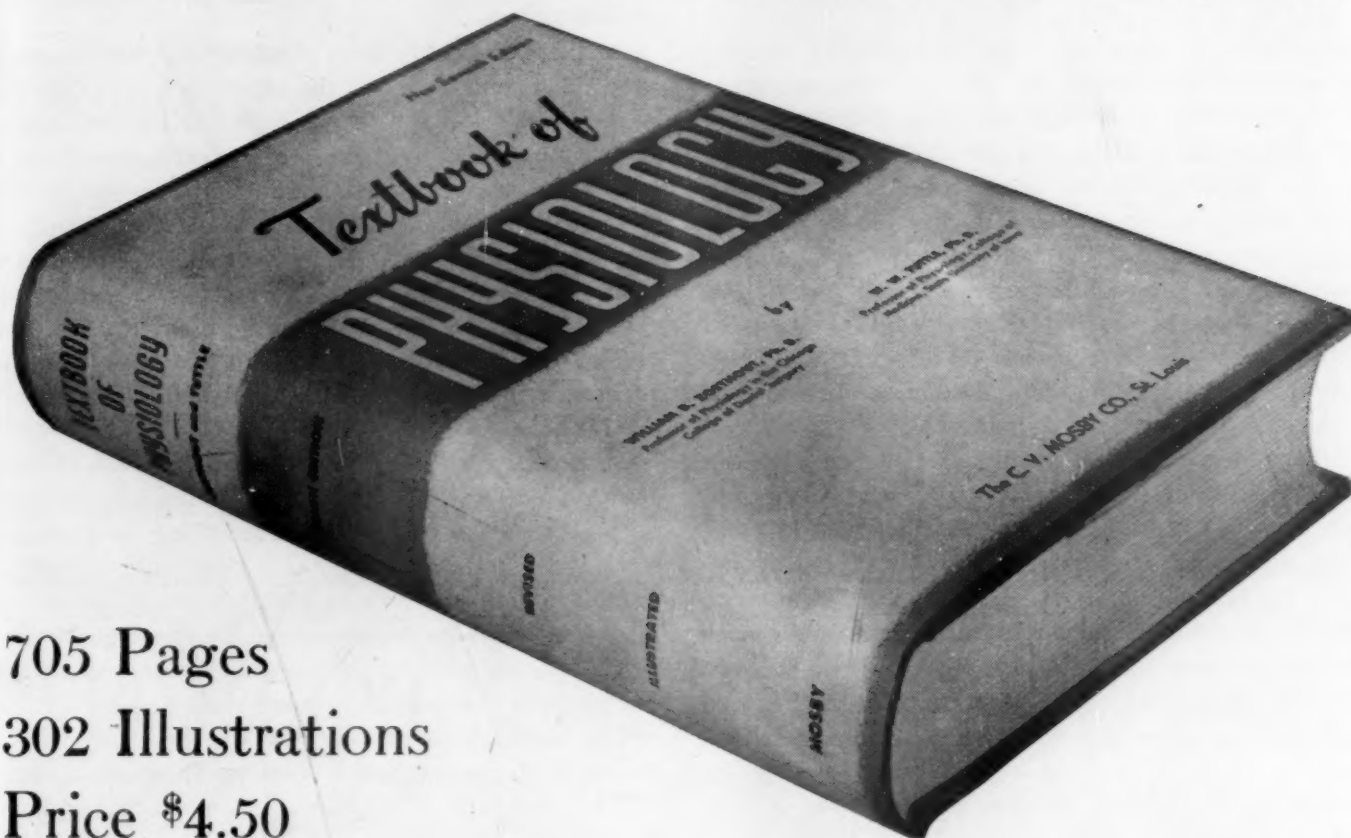
THE Rockefeller Foundation of New York City has given the University of California the sum of \$1,150,000 for the construction of a new and much larger cyclotron or atom smasher to be used in the radiation laboratory, of which Professor Ernest O. Lawrence is director. The university must raise \$250,000 from other sources to obtain this gift.

The plans for the new cyclotron call for a mechanism, or a fine integration of mechanisms, that will produce energies in excess of 100 million volts, as compared with the 33 million volts produced by the present 60-inch cyclotron. The weight of the new cyclotron will be 4,900 tons, or more than 20 times heavier and bigger than the present instrument.

The present cyclotron, the largest in the world, is said to have permitted striking new advances in the knowledge of the atom and also in the fields of biology and medicine, particularly through its production of artificially radioactive substances and its potent neutron rays. As compared to the 60-inch magnet of the present cyclotron, the magnet of the new instrument will measure 184 inches. It is hoped to produce a deuteron beam of 140 feet, as compared with the five-foot beam obtainable at present. It will be 58 feet long and 15 feet wide and will have an over-all height of 36.8 feet, of which 11.8 feet will be underground. From the emplacement the superstructure will rise to 25 feet. The estimated weight of the steel that will be used in construction is 4,500 tons, to which the copper windings will add 400 tons. A feature will be the underground location of the control room, 150 feet from the cyclotron itself.

The new cyclotron will resemble the present medical cyclotron, but in details it is planned to be the most distinctive engine of its kind. The designers in the radiation laboratory state that, because it is the first of its size ever planned or even contemplated, its actual operation may compel changes that can not be predicted at present.

At this stage its objectives are of a purely physical nature, with the structure of matter as the particular problem to be solved. However, as Professor Ernest O.

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The style of the book is clear, exact, and explanatory, and the illustrations supply graphic impressions that will not easily be forgotten.

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Lawrence, director of the radiation laboratory, points out, no one knows what new objectives it may light up or what new problems it may produce or solve.

A tentative site has been selected in the hilly section of the campus, to the east of the present radiation laboratory. Plans for the building also are in the tentative stage, but it is known that it will be devoted solely, in its beginnings at least, to the physical aspects of cyclotron research. There will be no biological laboratory as in the present plant.

ELECTRON PHOTOGRAPHS OF MOLECULAR STRUCTURE

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BY whirling a heart-shaped rotating disk in front of a photographic plate against which electrons are falling, a new way has been found of making what might be called architectural blueprints from which the structure of molecules can be worked out. Professor Peter Debye, of Berlin, speaking at the meeting of the American Chemical Society in Cincinnati, described the new feat of getting photographs of the scattering of electrons in gaseous chemical compounds. These "bull's-eye" pictures—each consisting of a black spot with a series of concentric rings—enable chemists to calculate the structure of the molecules and help determine directly the distances between atoms in the molecule.

Professor Debye, who is director of the famed Kaiser Wilhelm Institute of Physics, stated that his twenty-four-year-old son is the inventor of the new advance in molecule portraiture. Professor Debye is now a visiting lecturer at Cornell University. His son had planned to present his new apparatus for his doctorate dissertation at Berlin this year but was in America when the war started last September. Knowing that his father was coming to America, he stayed over and is now in Ithaca, too.

Getting bull's-eye ring pictures of molecules is done by shooting electrons, with potentials of 30,000 volts, down a small vacuum chamber where they pass through the molecular gases being studied. These gases scatter them into the characteristic rings. The nearer the atoms are together in the molecule, the greater is the angle of scattering and the larger are the rings. The scattered electrons are allowed to fall on photographic plates and make permanent pictures.

The new procedure is to place a heart-shaped rotating disk just in front of the photographic plate on which the electrons fall. The size of the opening in this disk and its outside pattern enables Professor Debye to obtain the ring pictures with the outer rings much more clearly exposed and with better uniformity. In older ring pictures taken with other methods the center of the rings became severely over-exposed and darkened if scientists attempted to make clear the much fainter outer rings.

Professor Debye said that the 30,000 volt electrons produce waves corresponding to only a twentieth of an Angstrom unit of length. One Angstrom is one one-hundred-millionth of a centimeter. It is about the distance separating atoms in the molecules which Professor Debye studied. These molecules have been carbon tetra-

chloride, carbon disulfide, acetylene and ammonia.—
ROBERT D. POTTER.

INFRA-RED RECORDS OF THE ECLIPSE MADE IN TEXAS

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THE dimmed sun's rim was photographed and studied in the light of its invisible infra-red radiation, to get hitherto unrecorded data on the nature of its outer envelope of gases, during the annular eclipse on Sunday, April 7. The unique observations were made by an expedition from the McDonald Observatory of the Universities of Texas and Chicago, on a mountain top in the remote and rugged Big Bend country, 85 miles from the nearest railroad.

Complete success under a cloudless sky was reported by Dr. C. T. Elvey, leader of the expedition, although details of the results will not be available until after many days of computation and measurement. Instruments used were a four-foot telescope with a six-inch lens, equipped with filters to cut out all but the infra-red wavelengths, and a thermocouple hookup to translate heat from the radiation into electric impulses which were recorded on photographic paper. With Dr. Elvey were Dr. Fred T. Rogers, Jr., of Yerkes Observatory, who designed the special equipment, and Walter Linke and Arch Garner, both of the McDonald Observatory.

An expedition from the American Museum of Natural History, led by Wayne Faunce, vice-director, observed the eclipse from the top of a tall building in Jacksonville, Fla., and from an airplane at a three-mile altitude. Although the effect known as Bailey's beads, caused by the mountain peaks on the moon nicking the edge of the sun, could not be visually observed, it was picked up by photographs taken at the ground station.

The expedition from Brown University, led by Professor C. H. Smiley, which went to Thomasville, Ga., had the hardest luck of the day. Rain fell throughout the entire eclipse period.

While astronomers were watching events in the heavens, physicists of the Carnegie Institution of Washington were making observations of its effects closer to earth. They were concerned with changes in the ionization, or electric charges, of the "E" and "F" layers of the earth's "radio roof," which affect radio wave reflection and hence range and clarity of transmission.

Dr. L. V. Berkner, of the Department of Terrestrial Magnetism, reported that ionization of the "E" layer dropped sharply at the beginning of the eclipse, held steady until its end, then rose again to higher than normal level. In the "F" layer, ionization held steady until 15 or 20 minutes after the beginning of the eclipse, then dropped about 20 per cent., rising again as the shadow passed off the sun.

THE PRODUCTION OF ARTIFICIAL HORMONES

LARGE-SCALE laboratory production of artificial hormones necessary for reproduction and maintenance of life is foreseen as a result of the total synthesis of a new chemical announced by Drs. Lewis W. Butz, Adam

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THE SCIENTIFIC MONTHLY

J. McKEEN CATTELL, F. R. MOULTON and WARE CATTELL, Editors

CONTENTS FOR APRIL

SCIENCE AND SOCIAL EFFECTS: THREE FAILURES. PRESIDENT ISAIAH BOWMAN.

SEVENTY YEARS OF SUEZ. PROFESSOR W. O. BLANCHARD.

MANAGEMENT OF AQUATIC WILDLIFE IN THE GREAT BASIN. PROFESSOR ANGUS M. WOODBURY.

DEVELOPMENT AND MANUFACTURE OF OPTICAL GLASS IN AMERICA. M. HERBERT EISENHART AND EVERETT W. MELSON.

ANALYSIS OF WORLD'S FAIRS' HEARING TESTS. H. C. MONTGOMERY.

ORGANISM, SOCIETY AND SCIENCE. I. PROFESSOR R. W. GERARD.

MUSICAL INHERITANCE. PROFESSOR CARL E. SEASHORE.

THE "CHAIR" FOR INSECTS? DR. ROBERT C. MURPHY.

"MIND IS MINDING," BUT OR STILL. But, PROFESSOR JARED S. MOORE; Still, PROFESSOR LESLIE A. WHITE.

BOOKS ON SCIENCE FOR LAYMEN:

Children's Science Books Published in 1939; Photographing the Invisible; The Life of the Mind; The Rise of Civilization.

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Gaddis, Eleanore W. J. Butz and Russell E. Davis, of the U. S. Department of Agriculture.

The new chemical is a steroid, like the sex hormones and other chemicals which animals and plants construct from the food they eat. This particular steroid, stera-diene-tetracarboxylic acid, has never actually been isolated from the body. Dr. Butz and associates created it from acetylene, cyclohexanone, cyclopentanone and maleic anhydride, chemicals produced commercially from coal, water and limestone.

The synthetic sex and adrenal gland hormones which other scientists have made in their laboratories have been made from a simpler chemical isolated from the body and built into chemicals identical with the hormones. Because the Butz synthesis of the new steroid does not depend on first isolating a starting chemical from the body, it is expected to provide a quicker method of making the artificial hormones and also compounds related to cancer-producing substances used in the search for greater knowledge about cancer.

Details of the synthesis, which is part of a project designed to study factors concerned in reproduction in farm animals and was supported by funds provided under the Bankhead-Jones Act of 1935, appear in the current issue of the *Journal* of the American Chemical Society.

About 20 steroids have previously been synthesized in the laboratory by other workers in this country and abroad. These steroids have one feature in common, chemically: at least one of the four rings of the carbon skeleton has always been of a benzenoid type. Of the many steroids which have been found in animals and plants, less than 10 contain these benzenoid rings. Thus steroids of other types such as the adrenal and sex hormones mentioned, can not be easily made from the benzenoid type by known methods.

Dr. Butz pointed out that the newly developed method is able to produce steroids without these rings, the type that, according to present knowledge, predominates in nature.

A NEW CHEMICAL REMEDY

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DRAMATIC and speedy recoveries of five babies desperately ill with staphylococcus throat infections which in three cases required an artificial opening into the windpipe so that the babies would not choke to death were achieved by treatment with the new chemical remedy, sulfamethylthiazol, Drs. Donald Weisman and Hollis Russell, of St. Agnes Hospital, White Plains, N. Y., reported at a meeting of the New York Academy of Medicine.

Under the best possible conditions before the new chemical was available not more than half of the patients suffering from this infection of the windpipe, larynx and bronchi recovered, and the younger the child, the greater was the danger. Mortality from severe staphylococcus infections has been as high as 90 per cent.

An older boy with running ears, mastoid involvement and general blood stream infection with the staphylococcus germs recovered without operation under treatment with the sulfamethylthiazol which was also credited by the White Plains physicians with speeding the recov-

ery of another boy with severe osteomyelitis of the right thigh bone.

Peripheral neuritis, which has been reported in about one out of 100 patients following use of the new chemical remedy, was not observed in these children. Drs. Weisman and Russell suggest, on the basis of their experience and reports from other clinics where large numbers of children suffering from staphylococcus infection have been treated with sulfamethylthiazol, that the neuritis may be an affliction of adults only and that infants and children may have a greater tolerance for the chemical. Because of the danger of this complication, however, they advise using sulfamethylthiazol only under carefully controlled conditions and only in very severe cases of staphylococcus infection.

ITEMS

APRIL is the safest month of the year. The average of 285 deaths per day from accidents during other parts of the year drops to 251 in April, according to statistics issued by the Metropolitan Life Insurance Company. The reason for greater safety in April is that it is an in-between season, after the time when falls on the ice smothering from too many covers or gas asphyxiation are hazards and before swimming, boating and lightning accidents begin to take their toll.

MAUNA LOA, Hawaii's giant volcano reported in renewed eruption, has a reputation as a very gentle dragon; it has never killed anybody, although there is a history of between 25 and 30 outbreaks of varying intensity since white men first began to take note of its activities in 1832. Like Hawaiian volcanoes generally, Mauna Loa is not addicted to the violent explosive type of outbursts that blast whole islands with clouds of deadly gas, as did Mont Peleé in the West Indies in modern times, or smother cities with showers of fast-falling ash, as did Vesuvius in antiquity. It just quietly pours out great wells of lava, which flow down its flanks like enormous sluggish rivers. These may destroy houses, plantations, whole villages if they happen to be in the way, but the population has always had time to escape.

THE theory that petroleum is probably being formed on the earth on a substantial scale, in contrast to the usual assertion that petroleum supplies are limited and irreplaceable, was advanced by Dr. Gustav Egloff, director of the Universal Oil Products Company, at the Cincinnati meeting of the American Chemical Society. He said, "It seems altogether likely that nature is continually producing more oil underground, perhaps at a faster rate than gas pressure or pump stroke can bring it to the earth's surface." Dr. Egloff states that all the evidence for his theory is not known, but he adds that the lakes, rivers and oceans abound in fish and mollusks closely resembling those found in oil-bearing formations. Dr. Egloff said that in the last few years the oil industry has been discovering new oil reserves at the rate of 1,000,000,000 barrels a year in excess of that actually used. Total reserves now known amount to 20,000,000,000 barrels or 16 years' supply. He forecasts that the depth of oil wells would increase from the present two miles to three miles and eventually to four and five miles below the surface of the earth.

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SCIENCE NEWS

Science Service, Washington, D. C.

SCIENCE AND AMERICAN CULTURE

(Copyright, 1940, by Science Service)

DR. ARTHUR H. COMPTON, professor of physics at the University of Chicago, speaking before the meeting of the American Philosophical Society in Philadelphia, pointed out that science is a decisive shaping influence in American culture, not only in material things but also in our intellectual life, our amusements, our art and our religion. He said: "At no previous time in history has life been so greatly influenced by science as in the United States to-day. Throughout history man's cultural growth has followed the gradual growth of his scientific knowledge. Even before the outbreak of the present wars, America had become the leader in most fields of scientific endeavor. The tradition of the pioneer has made it relatively easy for the American to alter his habits as required by the introduction of new techniques, with the result that in this country social changes have gone ahead with the speed not found elsewhere.

"As long as such rapid changes are occurring, we can not hope to adapt the art of living as completely to our technological surroundings as was done in the case of the classical culture initiated by the Greeks and refined through the centuries to fit an essentially stable world. Yet we are shaping our lives on a more heroic scale."

Professor Compton laid special stress on the necessity for cooperation in making the fruits of scientific endeavor available to mankind. He said:

"Without cooperation, scientific knowledge can not be made effective. If men divide into antagonistic groups it becomes terribly destructive. Thus in the technological society of which American culture is the supreme example, science emphasizes as never before the need of a will toward cooperation, that is, of the love of our neighbors.

"Science thus plays a threefold rôle in American culture. First, it supplies a direct outlet for man's creative instinct in building the permanent structure of scientific knowledge. Second, it supplies the means of living a life richer in health and in its variety of experience. And third, it creates a world setting in which man must rapidly adapt himself to live as a part of a more extensive and more highly coordinated society."

THE "PIPES OF PAN"

(Copyright, 1940, by Science Service)

PROFESSOR DAYTON C. MILLER, of the Case School of Applied Science, in a lecture before the American Philosophical Society in Philadelphia, pointed out that the first of all musical instruments was the flute, and the number of notes in the various musical scales the world has known was fixed by the number of fingers used in playing various types of this instrument.

Primitive flutes made of hollow bones have been found in cave dwellings of the Stone Age, and primitive peoples still use flutes of the same kind made out of bamboo or hollow reed. The simplest flute plays only one note. To get a series of tones it is necessary to use a number of

them bound together—the "pipes of Pan" kind of instrument.

Then it was discovered (probably by accident) that a pipe or flute with a hole in its side could be made to produce two notes, as the hole was stopped or left open. By boring more holes, up to the total number of fingers available, a whole series of notes—the musical scale—could be played on the single tube.

Flutes have always been of three general types. The earliest ones were sounded by blowing across the open end; classic Greek flutes were of this variety. Later, a blow-hole was made in the side near one end; this "cross flute" was the ancestor of the modern orchestral instrument. The third flute type added a sort of artificial mouth in the shape of a whistle; of this type were the "recorders" mentioned by Shakespeare and Milton.

Having been the deciding influence in molding the musical scale, the flute itself came in for some revolutionary changes when Johann Sebastian Bach fixed that scale in essentially its present form, filling it up with half-tones. The simple tube with seven finger-holes could no longer meet the demands upon it—human hands lacked the necessary additional fingers. The problem was solved in 1832, when Theobald Boehm, of Munich, invented the modern keyed flute, which permits eight fingers to do the work of a dozen or more.

Professor Miller, who owns one of the most notable collections of flutes in the world, illustrated his lecture with an exhibit of fifty of his instruments, playing selections on some of them.

URANIUM FISSION

(Copyright, 1940, by Science Service)

FROM Stockholm comes the latest news on uranium fission—the amazing splitting of this heavy element by weak neutrons with the release of enormous amounts of atomic energy.

Nature prints a report of this work by Dr. Lise Meitner, an exile from Germany, who first suggested to Professor Otto Hahn, in Berlin, that his pioneer experiments really showed that uranium was split by neutron bombardment.

At the Research Institute for Physics in Stockholm, Dr. Meitner has been carrying out experiments on the capture "cross-sections" of atoms of lead, thorium and uranium exposed to the neutrons. The problem of cross-sections is a vital one in nuclear physics, for it helps to determine whether a bombarding particle like a neutron will be scattered by the nucleus or captured.

One may visualize "a capture cross-section" by a baseball analogy. The area over which a player, standing still, can catch a baseball thrown at him would be his "capture cross-section." All players would have different capture cross-sections for baseballs, just as the nuclei of atoms have different capture cross-sections for neutrons. This is a rough picture intended only to give a partial idea of the meaning of a cross-section as physicists use it.

Dr. Meitner says that the nucleus of lead atoms has a

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141

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—PROFESSOR ROBERT BALK, *Mount Holyoke College*

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cross-section of 2.5 units of atomic cross-section area. By comparison thorium has a cross-section over twice as large, or 6.0 units. Finally, uranium with mass 238 (the kind that releases atomic energy) has a cross-section of 1.5 and is thus small by comparison, so that having neutrons hit uranium atoms and split them is no easy task. The unit of atomic cross-section used is equal to 10^{-24} square centimeters, or 0.000,000,000,000,000,000,001 square centimeters.

SYNTHETIC ORGANIC CHEMICALS

THE manufacture of useful synthetic substances from common minerals in the crust of the earth promises to be among the most useful technologic accomplishments of the future.

The synthetic organic chemical industry has poured out in recent years drugs, dyes, perfumes and other chemical products by the thousands, made largely from the complexity of coal's molecules. Far less complex substances, such as clay, graphite, etc., are due to come into the technologic limelight.

Most exciting, perhaps, is the possibility of making artificial diamonds of industrial usefulness from graphite by the use of high pressures combined with high temperatures. Both the diamond and graphite consist of the single element, carbon. Found only in unusual localities in the earth's crust where in past ages conditions of heat and pressure have been right to result in their formation, diamonds are potentially much more useful technologically than as jewelry.

The extreme hardness of diamonds causes them to be used in drills and for cutting operations, despite their cost. Diamonds used for these purposes are usually black or dark in color.

If diamonds could be made synthetically at a reasonable cost, they would find wider use than they do in working metals, drilling and other such tasks. As a matter of fact, years ago artificial diamonds were made, but they were much too small for practical use.

The new hope for artificial diamonds comes as a result of extremely high pressures achieved at both Harvard University and the Geophysical Laboratory of the Carnegie Institution, in the neighborhood of 3,000,000 pounds per square inch. One of the experiments made at Harvard was the application of this pressure to graphite in the hope that pressure alone would make the change from graphite to diamond. The attempt was not successful. When high temperature is combined with high pressure, the result may be different.

From clay there has been made through research at the Massachusetts Institute of Technology a synthetic mica that potentially makes America independent of the supplies of mica from Madagascar that might be interrupted by war conditions. Clay and mica are closely related in chemical composition, silicon, aluminum and oxygen being their chief constituents. Clay is pressed out into a sheet, which is hard and brittle. If this untreated sheet is placed in water, it swells as clay will. But if it is first treated with a lead salt, the lead enters into combination with the atoms of the clay sheet in such a way that it keeps out any other substances, such as water, that come

along. A synthetic mica is formed. This substance called Alsifilm, is being manufactured by five companies already and is finding extensive use as an insulator in all sorts of products.

Research may be expected to find similar ways of treating other common inorganic minerals in order to produce substitutes for existing materials or substances with new combinations of properties fit for new uses. As in the case of the synthetic mica, many of these new developments will be worked out from the theoretical chemistry of the substances involved. By learning how the atoms are arranged, science is able to design new substances and then attempt to build them in the laboratory.—WATSON DAVIS.

SUPER-SPEED PICTURE OF A SNEEZE

LATEST aid in the war against the common cold, influenza and other respiratory infections is a super-speed picture of a sneeze which was taken by special technique for high-speed photography by Professor M. W. Jennison and H. E. Edgerton at the Massachusetts Institute of Technology. It is the first picture that shows what really happens when you sneeze. The droplets given off in the sneeze travel at the rate of 100 feet per second, for the fastest of them, according to a report made to the Society for Experimental Biology and Medicine. Photographs enlargements show that the droplets have an apparent diameter of six hundredths of an inch or less.

The size and speed of these droplets and other knowledge that it is expected to gain from further study is important in the fight against air-borne germs such as those that cause colds, influenza, measles and the like. When a person with one of these ailments coughs or sneezes, some of the infected droplets immediately fall to the ground, but the smaller ones never reach the floor at all. Evaporating almost instantaneously, they leave behind tiny nuclei, so small they are easily carried about by the lightest air currents. Some of these nuclei are believed to carry with them disease germs. This, according to Professor William F. Wells, of the University of Pennsylvania, explains the very wide and rapid spread of colds, influenza and the like.

The speed of the droplets as determined by the sneeze picture would result, in dry air, in nearly instantaneous evaporation, producing droplet nuclei. The speed of the droplets in relation to evaporation may be much more significant than has been realized, and appears to be a more important factor than settling velocity.

The sneeze picture showed that the involuntary closing of the mouth near the end of a sneeze tends to produce more and smaller droplets, and that the number of droplets from the nose is usually insignificant compared with the number expelled from the mouth. This may have an important bearing on the problem of germ infection because of the differences in the germs found in mouth and nose.

THE BLACK STEM RUST OF WHEAT

UNCEASING warfare goes on between wheat breeders and the most destructive of wheat's fungus foes, black stem rust. Although this fungus is known under only one

specific name, *Puccinia graminis Tritici*, it is an exceedingly variable species, and is constantly evolving new strains, principally by natural hybridization. So it has come to pass that many a hopeful immune strain of wheat has been developed, only to be overtaken in a few years by a new strain of the rust fungus.

The newest recruits to the army of immune wheats are announced from the Dominion Rust Research Laboratory at Winnipeg, Canada, by R. F. Peterson, T. Johnson and Margaret Newton. There are six new wheat strains, five from seed imported from Kenya Colony in Africa, the sixth a native Canadian product. All six have thus far shown very high resistance to 20 strains of rust, to which they were purposely exposed.

The one all-Canadian wheat variety in the group owes its existence to an observant farmer, M. S. J. McMurachy, of Strathclair, Manitoba. Mr. McMurachy noticed one rust-free plant in a field of rusty wheat, one day ten years ago. He kept the seed and increased it. When his planting of the new variety came triumphantly through the bad rust season of 1935 he brought it to the attention of the Winnipeg laboratory.

Quite properly, the new variety has been given the name McMurachy's Selection.—FRANK THONE.

RADIO AND SUN-CAUSED DISTURBANCES

IN the sun-caused electrical and magnetic disturbances that bring "black-outs" or interruptions to radio programs and telegraph lines, there is a calm before the storm.

About four days before brilliant auroral displays, caused by the magnetic storm, the strengths of distant broadcasting station signals are abnormally high, usually about double, and radio communication is at its best. The least disturbance in the magnetism of the earth precedes an aurora by about four days.

A ten-year study of radio waves and aurorae, conducted by Dr. Harlan T. Stetson, of the Massachusetts Institute of Technology, has disclosed this relationship.

A lag of about 1½ days from the time of the display of the northern lights to the night when broadcast reception is most interrupted indicates to Dr. Stetson that there is an accumulation of electrified atmospheric atoms in the radio ceiling, about 80 miles up, from which broadcast waves are reflected back to earth.

The sun's effect is more prompt on radio communication conducted by means of waves of shorter length and higher frequency. The greatest disturbances of the earth's magnetic field follow very shortly after the electrical disturbances producing the aurora have taken place.

Auroral displays, radio disturbances and magnetic storms are associated with sun-spots. A day or two, on the average, elapses after the occurrences of these great solar storms and the auroral displays. This strengthens the idea that electrified particles emitted from the sun, rather than ultra-violet light, cause the aurora and prolonged magnetic storms. The electrified particles travel much more slowly, requiring a day or more to make the journey covered by light in about eight minutes.

Such studies as those by Dr. Stetson may allow the prediction of magnetic and radio disturbances sufficiently

in advance to allow communications engineers to be ready for them.—WATSON DAVIS.

ITEMS

THE sudden freeze that recently swept over practically all the country east of the Rockies did a lot of harm, according to reports received by the U. S. Weather Bureau. Southern strawberries and early vegetables, just getting ready for market, were ruined over a large area. Peach blossoms shriveled in orchards all the way from Virginia to Georgia. Only apples escaped, being still in bud for the most part. In the North, little damage resulted because the spring has been so chilly that nothing much was in flower or far advanced in leaf when the freeze struck. Continued wetness, however, seriously retarded farm work and continues to do so. Corn and cotton planting alike are being held back.

A MICROSCOPE that "sees" by electrons, or particles of electricity, instead of light, and that can reach so far into the depths of matter that eventually it is expected that it will be possible to "see" atoms themselves was demonstrated to members of the American Philosophical Society by Dr. V. K. Zworykin, of the RCA's Electronic Research Laboratories. This latest electron microscope achieves magnifications of 25,000 to 30,000, instead of about 5,000 maximum with even ultra-violet light optical microscopes. The first research application of the perfected electron microscope is expected to be in biological fields. It is considered possible that the new microscope may help solve the problem of the nature of the viruses that cause certain unconquered diseases. Already in preliminary work unidentified particles, evidently associated with disease germs, but hitherto unsuspected, have been seen. Extremely fine particles in materials of industrial importance, such as rubber latex, are shown to have shapes different from those they were believed to have.

A RECORD distance for clear television reception was achieved when programs from New York City, 250 miles away by air line, were recently received on Whiteface Mountain, at Lake Placid, N. Y., by relay from the General Electric Company.

IN ordinary transport planes a descent which occurs more rapidly than 300 feet per minute has been found to be objectionable to passengers. With the new super-charged cabins on modern transports it is possible for a pilot to descend 900 feet per minute, if need be, without passenger discomfort, according to Walter Forster, of the Curtiss-Wright Corporation, in a report to the Society of Automotive Engineers.

HAVE you ever wondered how the amazing convolutions of band instruments—where the music goes round and round—are made? At a band instrument factory, at Grand Rapids, melted lead is poured into the instrument tubing. When it has cooled the tube is bent properly and hammered into proper shape and the wrinkles taken out. Finally the lead is melted away and the instrument buffed and polished, without injury.

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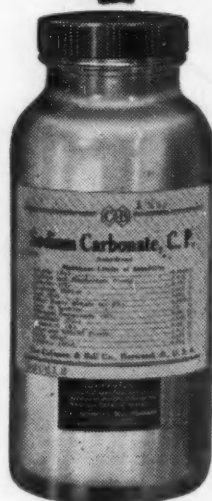
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SCIENCE NEWS

(Science Service, Washington, D. C.)

PAPERS READ BEFORE THE WASHINGTON MEETING OF THE AMERICAN PHYSICAL SOCIETY

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NEW and more accurate knowledge about the two essential building blocks of the hearts of atoms—the protons and neutrons—was reported by Professor E. O. Salant, of Washington Square College, New York University, and Dr. Norman Ramsey, fellow of the Carnegie Institution of Washington. Working with the 1,000,000-volt electrostatic atom-smasher at the Department of Terrestrial Magnetism of the Carnegie Institution, the collision cross-sections of protons when bombarded with neutrons were measured. All nuclei of all atoms, except hydrogen, are made up of combinations of neutrons and protons, so that the binding energies of these nuclear pairs is fundamental knowledge essential to an understanding of how the elements—and hence all matter—are composed. By the use of a “wall” of potential which appears to exist in atoms of copper the collision cross-sections of protons for “fast,” or high energy, neutrons which poured off a lithium target in the atom-smasher as it was bombarded with ionized particles of the heavy-weight kind of hydrogen known as deuterium were studied. These ions, called deuterons, struck the lithium target and by artificial radioactivity liberated from the lithium “fast” neutrons having energies up to 15,000,000 electron volts. Advantage was taken of the fact that copper is insensitive to neutrons weaker than 12,000,000 electron volts. This “threshold” permitted them to be sure that their experiments were carried out only with the “fast” neutrons of energies greater than 12,000,000 electron volts. By an “in and out” method the scientists measured the transmission of pieces of paraffin and carbon for the fast neutrons. Chemically the only difference in paraffin and carbon is that the former has two extra atoms of hydrogen in its molecule. As a result Professor Salant and Dr. Ramsey, after they had determined the collision cross-section for carbon, were able to insert this value in the collision cross-section for paraffin and—by simple subtraction—were able to determine the cross-section of fast neutrons on hydrogen atoms alone. Hydrogen atoms and protons have essentially similar collision properties, for they differ only by a single electron.

SOME of the difficulty which lies behind dreams of releasing atomic energy from the nucleus of the uranium atom was discussed in the report of K. H. Kingdon and H. C. Pollock, of the General Electric Company. Using a large mass spectrograph for separating uranium isotopes a mere speck of uranium of mass 238 was obtained after running the machine for three hours. One and eight tenths of a microgram of uranium concentrate was obtained. At this rate it would take some 70,000 days (over 191 years) to produce a gram of the uranium concentrate. The key step in the possible production of atomic power by the continuous release of energy from

uranium atoms has been the attempt to concentrate uranium from its ores so that a chain reaction can be produced. There has been some evidence of this chain reaction, but the final test will come only when science is able to concentrate sufficient samples of uranium in pure form. While nothing was said about uranium fission and the release of atomic energy, the results have an important bearing on the problem if only to point out to others the complexity and difficulty of uranium concentration.

THE new invisible films on glass which now reduce lost light by reflections from camera lenses and other optical parts can be made as durable as glass itself, according to Dr. C. Hawley Cartwright, of the Massachusetts Institute of Technology. Evaporated films of magnesium fluoride on glass can be greatly hardened by heat treatment. The effective hardness can be further increased by the application of oil or soap, which serves as a lubricant and makes the film waterproof.

SUGGESTIONS that long invisible infra-red radiation could be used to pierce fog were refuted by experiments reported by J. A. Sanderson, of the U. S. Naval Research Laboratory, Washington, D. C. The infra-red absorption of clear natural fog in the infra-red region out to wavelengths of 12 μ , or 120,000 Angstroms, was measured. The limit of ordinary vision is in the deep red near 7,500 Angstroms. Mr. Sanderson found that the transmission of the long infra-red rays was fairly uniform throughout the entire region studied, which leads “to the result, in accordance with previous measurements and theory, that there is no important advantage in employing long wavelength infra-red light in seeing through fog.” It was also found that falling snow scatters all wave-lengths equally so that in a snowstorm there would be no special advantage in infra-red radiations.

HOSPITALS using the new high-powered 1,000,000-volt x-ray tubes in the treatment of cancer must change their procedure in using the erythema reddening of the skin as an index of dosage, according to Dr. G. Failla and Mrs. Edith Quimby, of Memorial Hospital, New York City. A frequent method of collimating the 1,000,000-volt x-rays is to pass them through a lead opening whose open end is covered with a piece of bakelite. This bakelite, it has been found, creates large numbers of so-called secondary electrons which are highly effective in producing skin reddening. Dr. Failla and Mrs. Quimby reported experiments in which they set out to demonstrate clearly the creation of these unwanted secondary electrons in the x-ray beam. To do this they radiated a patient with a beam of 1,000,000-volt x-rays which passed through nothing except air for the last 10 inches of its path before reaching the skin. They covered half the exposed area with a piece of rubber sheeting. It was found that after a given treatment the skin under the rubber sheeting was strongly reddened, while the uncovered area still showed no erythema reddening. They showed that the reddening of

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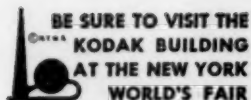
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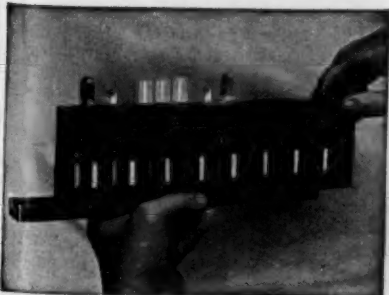
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the skin as an index of x-ray dosage in cancer treatment may be permissible for 200,000-volt x-ray tubes widely used, but that it is not a proper gage of dosage for the new 1,000,000-volt x-rays. They claim that with 1,000,000-volt x-rays there should be nothing in the x-ray beam as it comes to the patient that will create secondary electrons.—ROBERT D. POTTER.

THE MIGRATIONS OF BODY PROTEIN MOLECULES IN SOLUTIONS

(Copyright, 1940, by Science Service)

THE way protein molecules of the human body migrate in solutions under the influence of electric current may make possible a rapid and accurate diagnosis of disease.

Dr. D. A. MacInnes, of the Rockefeller Institute for Medical Research, New York City, told of the new method in a lecture at Western Reserve University sponsored by the Society of Sigma Xi.

Dr. MacInnes, now completing a two weeks' lecture tour across the continent addressing Sigma Xi chapters at eight universities, described the new robot "moving boundary apparatus" which makes it possible to get patterns created by normal blood plasma, and the plasma and serum patterns in different diseases.

The black and white diagnostic outlines are called schlieren patterns and consist of a series of peaks. In normal blood one peak, the largest, is caused by albumin A found in the blood plasma. Other and smaller peaks are caused by other proteins in the blood, three globulins—alpha, beta and gamma—and by the fibrinogen. The heights of these peaks and their relationships to one another appear characteristic of different conditions of the blood. Normal blood, for example, gives a standard schlieren pattern.

It is found in many diseases which have the common characteristic of fever—pneumonia, peritonitis, rheumatic fever and lymphatic leukemia—that in every case the peak representing alpha globulin was greatly enlarged. It may be possible that when scientists have extended the new method they will be able to "read" schlieren patterns of blood plasma as readily as a spectroscopist can look at spectrum plates and distinguish the bands and lines of molecules and atoms.

Dr. MacInnes credited Arne Tiselius, of Sweden, with improvement in the moving boundary apparatus which has made possible the new advance. For the development of the automatic recording apparatus to obtain the schlieren patterns he praised the work of Dr. Lewis G. Longworth, also of the Rockefeller Institute.

The schlieren patterns of blood are obtained by passing a beam of light through a composite solution of blood proteins. This beam, eventually, falls on a photographic plate. As an electric current is applied to the protein solutions they start to move—some faster than others—so that soon a series of boundaries between the different proteins originate. The light, shining through these boundaries, encounters materials with different refractive indices (light-bending power).

By optical means these boundaries show up at the peaks of the schlieren patterns.

THE VIRGIN FORESTS OF THE CANADIAN NORTHWEST

(Copyright, 1940, by Science Service)

WORLD WAR II is taking a heavy toll of the Pacific Northwest's famous but almost irreplaceable tall timber, one of the last stands of big trees in the world.

Cutting of Sitka spruce, the 250-foot forest monarch whose best cuts go into military training planes, is up about 50 per cent. since the declaration of war, according to the British Columbia Forest Service. The available supply of virgin spruce will last less than 40 years at the present rate of cutting, instead of the 50 years the pre-war cutting rate would have allowed.

The take of Douglas fir, best Pacific coast lumber tree and one of the finest in the world, is such that virgin stands of this species of fir will not last more than fifteen years. Production is temporarily off because of a shipping shortage, but once the shipping difficulties are solved (and they will be), the rate of cutting will exceed that of 1939, which exceeded 1938.

In not too many years the familiar barge loads of Douglas fir "peeler logs" from the Pacific coast islands will be a sight of the past. The 12-foot-long, stout "peeler logs," cut from the butt of the tree, are top-grade lumber.

Tragedy of both Sitka spruce and Douglas fir is that neither achieves its outstanding qualities of strength in much less than 250 years. This slow period of growth combined with a peculiar system of timberland holding in effect in British Columbia, makes forest "harvesting"—in which the annual cut is limited to the annual growth—appear an impractical dream for these two trees.

Timberlands are not owned outright, but revert to the government when the timber has been cut. The right-holder must pay an annual tax of \$140 a square mile as long as the land is not cut and he holds it. He would need rights on simply immense areas to get any harvest at all from such slow-maturing trees. At \$140 per section per year, this is not economically feasible. Instead, the timber baron "cuts out and gets out."—LEONARD H. ENGEL.

PROPOSED EXCHANGE PROFESSORSHIPS BETWEEN INDUSTRIES AND UNIVERSITIES

(Copyright, 1940, by Science Service)

EXCHANGE professorships between major industries and great universities, for beneficial mutual interchange of practical and scientific ideas, were proposed at the conference of the Industrial Research Institute meeting in Cincinnati.

Dean E. L. Moreland, of the Massachusetts Institute of Technology, suggested that one of the most effective ways of increasing the cooperation between university and industrial research might be to have scientific men engaged in industrial research to teach courses for a year at a university, giving the students their background of experience in research in industry. At the same time a professor, expert in some field of research, would go into an industry and bring to its research problems a fresh approach.

Directors of research saw in the Moreland plan much good for universities because many of the industrial research men have themselves been in teaching. They saw less benefit to industrial research because the incoming professor might require his entire year to attain necessary orientation for his job. They seemed willing, however, to consider the plan and explore its possibilities.

In further discussions between industry, represented by the research directors, and education, typified by deans of engineering schools present, the industrial men aired their worries over the kind of training new graduates would be required for industrial research jobs are now receiving. L. W. Wallace, director of engineering and research of the Crane Company, Chicago, was the most outspoken of the research directors present. In part he said: "The college graduate of to-day is defective because he has neither the exploratory urge nor the inquiring mind so needed in industrial research. Few graduates have an appreciation of the value of the technical and patent literature and thus fail to realize that the point of departure in any industrial problem is the state of the art as disclosed by such literature. Moreover, few seem to know how to undertake a literature search. Few graduates to-day appreciate the value of making use of the processes of analysis and synthesis in their thinking which are so fundamental to successful endeavor. I would rather have a man schooled in these processes . . . than a man most skilled in the use of slide-rules, chemical balances and what not. I believe an undue amount of educational time is spent on these aspects and not nearly enough upon the intellectual and mental phases."—ROBERT D. POTTER.

ITEMS

SUCCESSFUL forecasting three months in advance of the best frequencies for use in dependable radio transmission has been achieved by the National Bureau of Standards, Dr. J. H. Dellinger and N. Smith, two of the government's radio experts, reported to the recent meeting in Washington of the International Scientific Radio Union and the Institute of Radio Engineers. The monthly predictions are published as graphs showing the maximum usable frequencies for radio waves reflected by the ionized layers, many miles high in the earth's atmosphere. To radio engineers such predictions are useful because they allow them to plan what communication channels to use. When the predictions were begun a year ago it was expected that they would be accurate within 15 per cent. and better than this fulfillment has been achieved. The predictions are based on the 11-year sun-spot cycle.

NEW evidence that water rising through plant stems is mainly pulled up by the leaves, rather than pushed up by the roots, is offered by Professor Paul J. Kramer, of Duke University. In re-attacking this old moot question of what makes water flow uphill, Professor Kramer used sets of half a dozen plants each, of several different species. He grew them in pots, with the soil covered with oiled cloth to prevent evaporation from its surface. First, he weighed each plant, pot and all, at suitable intervals, to determine how much water was lost by evaporation through the leaves—transpiration. Then he cut off the stem close to the ground and as quickly as possible attached a slender graduated glass tube by means of a

short piece of rubber tubing. The amount of liquid rising in the tube was a measure of the roots' ability to supply water without the leaves' pull from above. This effect was very small—only from a hundredth to a twentieth of the quantities of water handled by transpiration in the same plants before de-topping. In some cases the effect was even negative. Water was absorbed through the cut surface for two hours or more by some of the de-topped plants before the root pressure began to push water up in the tubes.

GERMS may play a part in the chemistry which causes formation of gallstones, according to experiments made by Drs. K. K. Jones and Marie Lorenz, of Northwestern University Medical School. The material of which gallstones are made may be present normally in gallbladder bile, but it does not crystallize into stones unless chemical conditions are just right. Specifically, fatty acids with long side-chains must be converted by oxygen to acids with short side-chains. If the flow of bile is stopped ferments from bacteria or from white blood cells may provide the oxygen for changing the long fatty acids into short ones with consequent formation of the stones. The work was described at the recent New Orleans meetings of biologists.

A DECADE ago, it was found that certain kinds of lubricating oils were distinctly improved by blending, but nobody knew why. Studies by Drs. W. D. Harkins, T. F. Young and George Boyd, of the University of Chicago, show that the superiority is due to the presence in the oil of certain large molecules formed by partial oxidation. In monolayers, or liquid films only one molecule thick, the individual molecule "stays put," but it may be spread out to varying thinness: as much as a ten-millionth of an inch or as little as a fifty-millionth. The more "spreadable" an oil, the better its lubricating properties.

LIQUID wood, produced by the same kind of methods by which Germany is now making much of its gasoline from coal, is the newest product of Canadian chemical science. Water-white liquids are obtained which it is expected will provide the raw materials for a future synthetic organic chemical industry. Professor Harold Hibbert, of McGill University, described the new way of processing wood at the meeting in Cincinnati of the American Chemical Society. One of the new liquid woods, Professor Hibbert explained, "is so closely related to the raw material from which the synthetic fiber nylon is made that it should readily prove possible to obtain from it a new variety of this interesting fiber, the raw material being wood instead of coal."

DR. L. E. JEWELL, Meridian, Idaho, has successfully used sulfanilamide as a scarlet fever preventive. He reports to the *Journal* of the American Medical Association that only one of 116 persons exposed to scarlet fever developed the disease when it was used as a preventive medicine. The one exception was a person who had been exposed to the disease five days before getting the sulfanilamide and developed the scarlet fever the day after treatment.



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SCIENCE NEWS

Science Service, Washington, D. C.

THE USE OF HISTAMINE IN ALLERGY

Good results in more than one third of a group of 94 sufferers from allergy following treatment with the chemical, histamine, were announced by Drs. Frank F. Furstenberg and Carl E. Arbesman, of Baltimore, at the meeting in Atlantic City of the Society for the Study of Asthma and Allied Conditions. Histamine, however, is not a panacea or a specific for allergic diseases.

It was found that the chemical is chiefly helpful to those patients whose asthma or hay fever symptoms are due to physical agents such as heat or cold, or those who have itching and hives from pressure of garters, girdles or suspenders.

Of the 94 patients treated with histamine during the last three years at the Johns Hopkins Allergy Clinic and in private practice, 45 got no relief from the treatment, 16 improved and 33 had excellent results. A few of the patients have been free of symptoms for more than two years. Some with good results had relapses but responded promptly to another series of treatment. Some patients still get the treatment once a month and remain well.

The chemical is injected under the skin in a very small dose at first, and the dose is gradually increased during the course of 14 injections three times a week. When the maximum dosage has been reached, the periods between injections are lengthened and the treatment tapered off with monthly injections.

The theory is that the symptoms are due to release of histamine in the tissues and that the small, increasing doses of the chemical will desensitize the patient to it. An enzyme, histaminase, which inactivates histamine, has been tried in allergic patients, but these were not reported.

Potassium chloride, another remedy for simple hay fever, did not prove to be of any value in the treatment of 85 patients, according to the report of Drs. Furstenberg and Leslie N. Gay, also of Baltimore.

HOPE that patients with hay fever, asthma, hives and other allergies can be helped by treatment with a new enzyme remedy, histaminase, is somewhat dashed by experiences two Los Angeles physicians, Drs. Hyman Miller and George Piness, report in the *Journal* of the American Medical Association.

The treatment gave no relief at all to five patients with chronic allergic skin disorders, five patients with chronic allergic bronchial asthma and three hay fever patients. Among 28 patients complaining of hives, a few reported relief following histaminase treatment, but the nature of this condition is such that it was impossible to state whether the relief was specifically due to the treatment. For example, one patient who had hives from exposure to sunlight experienced some relief from the itching while taking the histaminase capsules, but he was taking them at the season when his condition usually improved anyway.

The theory of the treatment is that the immediate cause of the signs and symptoms of allergy is liberation of the chemical, histamine, in the tissues. Histaminase is an

enzyme which antagonizes histamine. Capsules of this enzyme, obtained from hog's kidneys, are now being manufactured and offered to the medical profession as an effective remedy.

"The clinical value of the use of histaminase is highly questionable," according to Drs. Miller and Piness. Their conclusion from their own use of the remedy in 42 patients is that the treatment "failed to give unequivocal evidence that this enzyme was responsible for the relief or prevention of any of the signs or symptoms of which the patients complained."

GROWTH OF THE HUMAN BRAIN

(Copyright, 1940, by Science Service)

MAN'S evolution as a "brain animal," with a cerebral development that is an outright anatomical runaway, is primarily responsible for all the changes that have taken place in the human skull, according to Professor Franz Weidenreich, of the Peiping Union Medical College, who spoke at the meeting in New York City of the American Association of Physical Anthropologists.

Professor Weidenreich, leader of research on Peking Man, one of the most ancient of human races, held the extraordinary enlargement of the brain responsible not only for the necessary changes in the case of bone that houses it, but also for the changes in accessory skull structures such as the reduction in size of face and teeth as contrasted with conditions to be found in fossil and living great apes.

Analogous changes have taken place in the skulls of dogs. Small dogs, like King Charles spaniels, have skulls larger in proportion to the rest of their bodies than are the skulls of big dogs like wolfhounds; and with the relatively larger skull goes reduction in size of face and development of teeth.

"Dogs and man differ," said Professor Weidenreich, "only in that the brain of dwarf dogs has increased relative to the size of the body, whereas in man the brain is expanded absolutely. Similar relations and differences can be found also in other mammalian groups. These facts prove that the evolution of the special character of the human type is strictly orthogenetic and does not alter the basic pattern which man shares with the anthropoids."

ECONOMIC AND SOCIAL PROBLEMS OF NORTH AND SOUTH AMERICAN INDIANS

(Copyright, 1940, by Science Service)

A PERMANENT clearing house to aid 30,000,000 North and South American Indians in solving their economic and social problems is advocated by the United States Commissioner of Indian Affairs, John Collier.

Heading a delegation including scientific men and Indian Service officials from the United States at the first Inter-American Conference on Indian Life, in session at Patzcuaro, Mexico, Mr. Collier considers it strange that in the centuries since Columbus the governments of America have never before met to exchange ideas and experi-

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—PROFESSOR WALTER S. HUNTER, *Brown University, in the "Psychological Bulletin"*

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ences relating to Indian problems. An Indian Institute somewhere in the Americas would gather and give out information to American countries for possible use in improving Indian health, farming methods, education and well-being in general.

Emphasizing that the Indian can no longer be considered a dying race, which will solve its problems by vanishing, Mr. Collier reported that the Indian is the fastest-growing element in the United States' population. While these Indians are a tiny minority, only about 350,000 people, the need to work for their economic independence is increasingly apparent.

Methods of dealing with the land erosion problem on Indian farms and ranges were described to the conference by the chief of the U. S. Soil Conservation Service, H. H. Bennett. Teaching farmers to prevent erosion and to conserve water, he said, leads to more profitable agriculture, generally. The Indians learn to raise more varied crops and to bring idle land into production. Indians themselves were among the world's early soil conservationists. Incas or even earlier Indians in Peru recognized the menace of soil erosion and carried out one of the most costly and effective conservation programs in history. Many rock-wall terraces which they built across mountain slopes, for irrigating and for preventing the soil from washing away, are still in use.

VOLCANIC ACTIVITY IN THE CRIPPLE CREEK GOLD MINING FIELD

SLIGHT volcanic activity is believed to be going on in the famous Cripple Creek gold mining field in Colorado. One mining company has been studying its shafts which tap relatively unexplored underground regions in what was once a crater of a volcano which "blew its head off" probably millions of years ago.

Gas intrusions, seeping up into the mine from beneath, have hampered the work and it has been noted that just before such intrusions of gas, temperature and humidity in the mine go up. Troy E. Wade, secretary of the Cripple Creek-Victor Operators' Association, believes this shows the gas is warm and that it carries a mantle of vapor.

It is thought that the gas may be seeping in from fault crevices in the rock veins laid down by the volcano amid country granite and that the gas intrusion indicate traces of still-present volcanic activity.

Shafts as deep as 700 feet underground, in other parts of the crater, have revealed pieces of charred wood that may have been parts of forest trees hurled into the crater when the volcano exploded millions of years ago.

In recent years studies by A. H. Koschmann, geologist working for the U. S. Geological Survey and the Colorado Metal Mining Fund, have indicated that volcanic activity may have had only a little to do with the formation of the ores which have so far yielded \$400,000,000 in gold and silver values.

SYNTHETIC CRYSTALS

FROM earliest recorded times man has been using transparent solid materials to do things with light. The old-fashioned burning glass was a prized possession of early explorers, the simple magnifying glass led to the micro-

scope and a new world of the small, telescopes expanded man's knowledge of the universe, and the spectroscope led him into the world of the atoms.

To probe the invisible ultra-violet and infra-red light on the two sides of the visible spectrum, man soon learned that ordinary glasses were insufficient and turned to natural crystals like quartz, calcite and rock salt because they could still transmit radiation in these regions of wave-lengths. The world was combed for bigger and bigger crystals of these materials to go into the instruments of science.

Now, however, synthetic crystals are being grown by science, according to a report prepared for the American Chemical Society by Drs. H. C. Kremers, of the Harshaw Chemical Company, Cleveland.

Synthetic single rock salt crystals up to 25 pounds in weight are grown from which prisms five inches tall and with 6-inch faces can be cut. These prisms are especially good in the infra-red region of the spectrum and will transmit out to 200,000 Angstroms in wave-length. The human eye can see only so far at 7,500 Angstroms in the deep red.

Other huge synthetic crystals now being grown include those of sodium nitrate, potassium bromide and lithium fluoride; the latter especially useful in the ultra-violet region.—ROBERT D. POTTER.

A NEW WOOL-LIKE NYLON

(Copyright, 1940, by Science Service)

A NEW patent, by the U. S. Patent Office, covers the production and processing of a crimped wool-like fiber made from nylon. The new patent is issued to John Blanchard Miles, Jr., of E. I. du Pont de Nemours and Company, and is assigned to du Pont. The new wool-like nylon is said to approach, "and may even equal" wool in its heat-insulating properties. Other claims of superiority include strength, heat stability, dyeing characteristics, elasticity, mothproofness and immunity to any harmful action by common cleaning fluids or processes.

E. K. Gladding, manager of the nylon division of du Pont, says there is no immediate commercial production planned for the new wool-like nylon fiber. Such production will require new types of manufacturing equipment, all of which must be designed and built.

The patent covers the conversion of filaments from synthetic linear condensation polymers, particularly polyamides, into wool-like fibers by mechanical methods of "crimping" either prior to, during or following the "cold-drawing" process which is used in making nylon yarn. In general the patent states that at least four crimps to the inch are required to obtain a wool-like material.

The retention of the crimp quality after the stretching that occurs in normal use is improved by hot water or steam setting treatments. The new fiber lends itself to the preparation of mixed fibers and its luster can be controlled in manufacture to improve its appearance.

Nylon is the chemical material which in fine filaments can be made into sheer, strong and water-repellent hosiery now on the market. In thicker filaments it is being used for fish lines and leaders, and coarse bristles of nylon are appearing in toothbrushes. The application to a crimped

wool-like fiber is the newest achievement of this versatile chemical material.

"ERSATZ" COD-LIVER OIL

(Copyright, 1940, by Science Service)

"ERSATZ" cod-liver oil will be used next winter as a result of the war in Norway, according to a prediction made by Robert William Rodman, of the *Druggist's Circular*, at the Richmond meeting of the American Pharmaceutical Association. He said: "When Germany invaded Norway early last month and the Scandinavian area became the present locale of World War II, the source of supply of 70 per cent. of the cod-liver oil used in the United States was immediately cut off and this nation faces a real shortage in this important medicinal product. The hostilities came at a bad time for the cod-liver oil industry as spring is the big cod-fishing season and stocks of oil in this country are at their low point of the year following heavy winter sales when vitamin products are in the greatest demand.

"Norway's chief fishing ground for cod is around the Lofoten Islands near Narvik, which has borne the brunt of intensive air, sea and land fighting, and the two principal refining centers are Bergen and Aalesund, both of which are or were in the hands of the German army and have, therefore, been the target for aerial warfare.

"It is doubtful, even if the war should end to-morrow, that fishing and refining activities could be sufficiently re-established during the current season to afford much relief from the shortage which is imminent and which will be felt even more next fall and winter when cod-liver oil will again be in great demand as a vitamin tonic."

Cod-liver oil is valuable for its content of vitamins A and D, the latter being the rickets-preventing vitamin. Both of these vitamins can be prepared from other sources, and Mr. Rodman predicted that the cod-liver oil shortage resulting from the war will speed up research in the production of substitute fish liver oils and the manufacture of synthetic vitamins A and D. Iceland and Japan have been supplying 30 per cent. of U. S. cod-liver oil imports in recent years.

The United States is in much better position with regard to medicinal chemicals than it was at the outbreak of the World War in 1914, but the market for botanical drugs has been disrupted for months by the present conflict. Germany, Hungary, Czecho-Slovakia, Yugoslavia, Poland and Russia supplied the bulk of these imported by the United States. The future supply depends largely on what Italy may do. If she joins Germany it will be "virtually impossible to obtain botanical drugs from Europe." These drugs include ergot, lavender flowers, orange peel, cascara, cantharides, camomile, malva flowers, buchu, henna, peppermint, gentian, arnica flowers, senega, anise, juniper berries, poppy, fennel, and arabic, asafetida, myrrh and benzoin gums.

Japan's recent suggestion of interest in the Dutch East Indies has worried the drug trade because the Indies are the source of the world's supply of cinchona bark from which quinine is made. Mr. Rodman pointed out that not only the world's quinine supply but through it world trade

in other commodities might be upset if Japan should seize the Indies.

ITEMS

IN the canebrakes in Liberia lives a rat species two feet in body length, specimens of which have been captured by Dr. Wm. M. Mann, now in the jungles of Liberia to obtain new beasts and birds for the National Zoological Park in Washington. Other prizes captured by Dr. Mann include a pygmy squirrel, mouse-sized and equipped for gliding like our native flying squirrels; a potto, which is a big-eyed, nocturnal lemuroid, among the lowest of the ape-monkey tribe; and a number of duikers, which are tiny antelopes believed by the natives to possess four eyes apiece. The extra "eyes" are really slit-like glands near the nostrils.

THEY'RE called both May-beetles and Junebugs: you may take your choice. Naming anything by the calendar is bound to result in inaccuracy, if the organism is at all widely distributed, for it is bound to appear through a range of several weeks, as spring moves up the map. These beetles appear in May, or even earlier, in part of their range; farther north not until June. May-beetles may seem to be rather harmless, if blundering, creatures. But in their infancy they constitute a major pest, for their larvae are the terrible white grubs that are the ruin of lawns, golf greens, strawberry patches and gardens generally.

DISCOVERY of 7,000 crude stone tools made by unidentified American aborigines, who used the same techniques as Europe's Stone Age people of half a million years ago, is reported by Dr. E. B. Renaud, of the University of Denver. Dr. Renaud found the rough chopping and scraping implements during his archeological survey of the High Plains in Wyoming. European archeologists, to whom he has sent samples of the American stone work, agree that the work is strikingly like early stone industry of Europe's Old Stone Age. Dr. Renaud reports that he has no evidence yet as to age of the American finds, and that he has no reason to think they are as old as Europe's Old Stone Age. The bulk of the collection was obtained on the surface at three sites in a terraced river valley.

A COMBINATION of a chemical used during the World War as a high explosive, dinitrophenol, and the drug sulfanilamide is prolonging the lives, with possibilities of permanent cure, of guinea pigs having tuberculosis. These animal experiments, indicative of a possible method of treating human tuberculosis, were reported to the American Chemical Society by N. L. Howell and E. C. Link, of Memphis, Tenn., who said: "While the experimental work is only preliminary, it is extremely significant that of the experimental animals treated all, with the exception of one animal, lived from five to 15 months after date of infection. This is a ripe old age for tuberculous guinea pigs." The use of the dinitrophenol is based on the idea that some chemical is needed to penetrate the bacillus causing tuberculosis so that entry can be made for the sulfanilamide. This idea, they added, is not new and is frequently necessary to stain certain micro-organisms in the laboratory. Carbolic acid, they said, is often used for this purpose.

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SCIENCE NEWS

Science Service, Washington, D. C.

ATOMIC POWER

(Copyright, 1940, by Science Service)

Is atomic power at hand? Here is the way *not* to write the story of this possibility, but the flood of reports which have swept the country telling of the isolation of a rare isotope of uranium with mass 235 and the possible implications of this discovery for releasing atomic power, make it highly desirable that some one sit down, take off the gloves, separate fact from fancy and give a fair picture of what is happening. Here are the facts. Fantasy may come later.

1. Over a year ago, when it was first discovered that uranium atoms could be split by bombardment with neutrons, neutral atomic particles, and made to release a large measure of the atomic energy, Professor Niels Bohr, of Denmark, Nobel Laureate, and Dr. John A. Wheeler, of Princeton University, forecast that atoms of uranium 235 would probably be split by very weakly energetic, "slow" neutrons. Only high energy neutrons, they predicted, would be successful in splitting the common form of uranium with mass 238.

2. Occasion for the recent spectacular retelling of the story of uranium fission, which has been reported again and again since late in January, 1939, was the confirmation of the Bohr prediction on uranium 235 by Dr. A. O. Nier, of the University of Minnesota, and Drs. E. T. Booth, J. R. Dunning and A. V. Grosse, of Columbia University.

3. Dr. Nier made possible this confirmation by isolating, in an instrument known as a mass spectrometer, the tiny sample of uranium 235, which was only a few millionths of a gram of material. Others, including Drs. K. H. Kingdon and H. C. Pollock, of the laboratories of the General Electric Company, have been effecting similar concentrations of uranium 235 and uranium 238, its heavy common isotope. Professor J. W. Beams, using a gold-plated centrifuge at the University of Virginia, has been working on the problem, but is having the material he has isolated checked in a mass spectrometer to determine its atomic weight. He has just told Science Service that he has no specific report to make until this mass spectrometer test is concluded.

4. The isolation of the uranium 235 isotope is extremely slow, tedious and costly in time and effort. Figures discussed by Drs. Kingdon and Pollock show that even for the much more abundant uranium isotope of mass 238 it takes three hours of operation to produce one and eight tenths of a microgram, where a microgram is a millionth of a gram and a gram is less than one four hundredth of a pound.

Simple computation shows that at this rate it will take some 70,000 days (over 191 years) to make a single gram of concentrated uranium 238 and over 400 times as long—over 75,000 years—to make a pound of this material. The rare isotope of uranium of mass 235, occurring in only one part in 139 in comparison with uranium 238, would take still longer for its production.

5. It has been definitely shown that a chain reaction

occurs in uranium fission with neutrons. The only new thing in this is that it has now been confirmed in an American laboratory. Some months ago this same fact was announced from Paris by Professor F. Joliot and his colleague, Dr. H. von Halban. The new American work probably confirms this fact more thoroughly than before, since the scientists supposedly were working with the pure, concentrated uranium of mass 235.

So much for the facts about uranium's fission which, unembellished, are seemingly prosaic. Much better reading—and the cause of the wide-spread use of the recent story—is the speculation about the future of the possible release of atomic energy from uranium.

Taking off from fact into fancy one can cite the following:

1. The separation methods of isolating uranium 235 are bound to improve so that while it may take over 75,000 years to concentrate a pound of uranium 235 to-day it may be done far quicker in the future. Perhaps the wish for a five-pound chunk of the stuff can be realized within our times.

2. It may not be necessary to have pure uranium 235 (U-235) to find practical uses. True, the U-235 works best with the weak neutrons, but uranium 238, much more common, splits with fast, high-energy neutron bombardment. It can be recalled that the discovery of uranium fission was obtained with uranium oxide—a commonplace chemical compound widely spread throughout the earth.

3. The energy liberated from uranium by fission is enormous and weight for weight it is at least 5,000,000 times as effective as coal.

4. If the chain reaction of having one uranium atom split and liberate the neutrons which will split another one near by and so on, can be controlled, then a compact power source for military purposes could be achieved despite whatever the cost might be. Things which are uneconomical in a peacetime sense become practical for military services if they can perform tasks not possible, or carried out as easily, in any other way. No price can be put on such developments that might save the life of a nation which owned the discovery, any more than one can put a price on a surgical operation which saves a man's life.

5. Is Germany pressing the utilization of the discovery of uranium fission? The answer is probably yes, for it has been pointed out since the first announcement of the sensational find that Germany was the home of the original discovery, and that Germans have had a six months and more start on their research.

This drive is going on in all nations and does not require the special large cyclotron atom-smashers which dominate the American scientific scene.

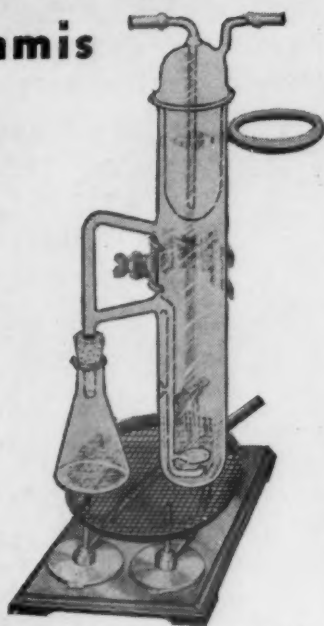
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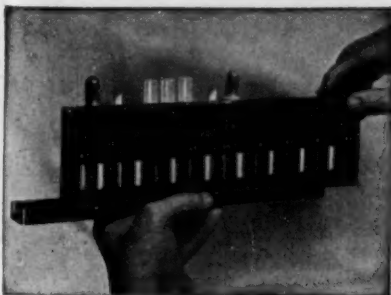
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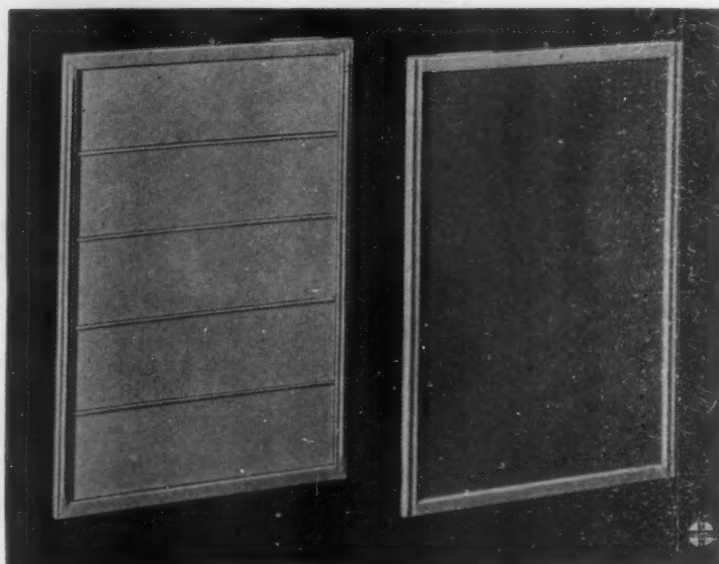


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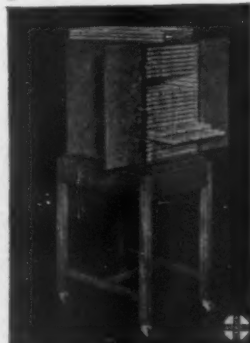
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entire "source" that is required. This radium-beryllium mixture is a source of neutrons and with these to bombard uranium the uranium splitting and its own chain reaction do the rest.

Those five points are the fancy which may or may not come true within our times. There are others, like the uranium bomb, which go beyond fancy into the fantastic. One would be a fool to say that these possibilities will not happen when it is less than two years ago that talk of atomic power was relegated to talk of perpetual motion, ancient medieval alchemy and the search for the philosopher's stone.

Probably the sanest forecast of the future is that uranium atomic power will be so valuable when and if it comes that it will be used only for the most special purposes for which it is characteristically adapted and which it can do better than anything else.

Still nearer to reality as a forecast is that the discovery of uranium fission will have its greatest benefits as a ready-at-hand, compact source of neutrons which are highly sought-after in medicine and biological experiments and in nuclear physics. At present huge and costly atom-smashers are necessary to create these neutrons for experiments. If the chain reaction can be started and controlled in uranium, every university laboratory could have its own neutron source. The benefits to research on understanding the structure of atoms—and hence all matter—would be immeasurably enhanced by this advice.—
ROBERT D. POTTER.

CONCENTRATION OF URANIUM

(Copyright, 1940, by Science Service)

A WAY to speed 11,000-fold the concentration of the element, uranium 235, from which it is hoped to obtain practical atomic power, is reported from Stockholm. But the spread of the European war has stopped, at least temporarily, the research that holds such promise.

With tubes about 30 feet high, Professor Wilhelm Krasny-Ergen, of the Wenner-Grens Institute of the University of Stockholm, was on the verge of concentrating, at a rate more than 10,000 times faster than ever before, the rare material which is a potential source of atomic power. Work had to be suspended when Germany marched into Norway.

The 24-hour yield of rare uranium 235 would be 1.3 milligrams per day, whereas the best yield reported up to now for the much more common uranium 238 is only 14.4 micrograms a day. This means that with a single tube in his thermal diffusion apparatus, Professor Krasny-Ergen would require about three years to get a gram of uranium 235. At the present rate of production with mass spectrometers in America it would require over 33,000 years to get a gram of uranium 235.

The thermal diffusion tubes, described in a report to *Nature*, are easy and cheap to make. A whole series of such tubes could be constructed and run in tandem, or separately, and greatly increase the yields of uranium 235.

Uranium of mass 235 is, weight for weight, about 5,000,000 times as potent in energy as is coal. Each time an atom of uranium is struck by a low-energy neutron (neutral atomic particle), it splits in two and yields

175,000,000 electron volts of energy. The aim has been to concentrate enough uranium 235 in one lump to test its ability to keep on liberating its energy by a "chain reaction" in which each fission of a uranium atom would yield more neutrons which could split other adjacent atoms, and so on.

PAPERS READ BEFORE THE NEW YORK MEETING OF THE AMERICAN ASSOCIATION OF PHYSICAL ANTHROPOLOGISTS

(Copyright, 1940, by Science Service)

Boys and girls now growing up show a tendency to become less tall than their older brothers and sisters of a few years ago, and also not to become mature men and women at so early an age. Data in support of this contention were submitted to the meeting of the American Association of Physical Anthropologists, meeting in New York on May 3, by Professor Clarence A. Mills, of the University of Cincinnati. Professor Mills was inclined to attribute this reversal in the human growth tide to a change in climates toward the warmer, rather than to any differences in the American diet. The tendency for young people of the recent generation to grow tall and mature early, which he said is now reversing itself, has been laid to improved diet. Yet the present generation of college students (on whom the studies have been based) is just as well fed as their taller immediate forebears. Need for more information, especially from foreign lands, was stressed by the speaker in his concluding remarks: "It seems likely that a profound racial change is taking place in humanity, physically as well as socially. It would be highly desirable to know whether a similar physical reversal is taking place in those foreign lands where the upward surge of the last half century has been most marked."

IDENTICAL twins are "more identical" physically than they are mentally, at least by any criteria at present available, it was pointed out in the address of Dr. C. B. Davenport, of the Carnegie Institution of Washington, with headquarters at Cold Spring Harbor, N. Y. After pointing out the extremely close resemblances of identical twins, even in such details as the dimensions and structure of their noses, Dr. Davenport went on: "However, in the mental reactions there is by no means identity and in certain details, like those of the papillary patterns, there is only a general resemblance." The speaker suggested that, in general, twins are most alike in characters that have the least complex genetic make-up. The more factors that are involved, the most likely there are to be changes, even though all the original factors were alike at the outset. Another cause for differences, as development proceeds, is to be sought in changing relations between the heredity-controlling genes and the cytoplasm, or general cell protoplasm, which is the instrument for the expression of hereditary trends.

RE-STUDY of the fossil ape skulls and teeth found in South Africa by Dr. Robert Broom, of the Transvaal Museum, in 1936, was reported in an illustrated lecture

recently by Drs. William K. Gregory and Milo Hellman, of the American Museum of Natural History. Their findings confirm those of Dr. Broom that the canine teeth of these apes are almost human, while the large molars combine human and ape features. According to Dr. Gregory, "Our reconstruction of the upper dental arch comes out in almost human form. The lower teeth also combine ape and human characters. These creatures probably represent persistent primitive forms that lived on in South Africa after man himself had arisen, possibly in another part of the world."

THE Indians who built the famous Hopewell mounds of the Ohio Valley and whose cultural remains have been found as far west as Iowa and Missouri, were brought a little closer to personal portraiture by a paper presented by Dr. T. D. Stewart, of the U. S. National Museum. Trouble with the Hopewellians is that they practised cremation, so that bones found in their elaborate funeral mounds have always been burned beyond any possibility of reconstruction. Therefore while investigators have been able to collect great amounts of data on their really beautiful workmanship in copper, shell, mica, obsidian, horn, bone and river pearls, they could never get an idea of what the people themselves looked like. However, some skulls from a Hopewell site near Kansas City, Mo., excavated by Dr. W. R. Wedel, of the National Museum, at last give a clue to the Hopewellians' personal appearance. Search in the great collection of Indian skulls has also brought to light specimens from the Illinois-Wisconsin-Iowa region, which had hitherto been overlooked. The typical Hopewellian skull appears to have been long and narrow—in Europe it might have been classified as either Nordic or Mediterranean. Similar skulls were common among more recent Indian tribes in eastern North America. There is also a pronounced narrowing of the forehead, which Dr. Stewart believes may have been artificially produced by binding of the heads of the young children. Head binding is common practise in many Indian tribes, though it is usually done in such a way as to cause a flattening instead of a narrowing of the skull.

EVIDENCE that Indians who once lived near Washington, D. C., practised the skull-piercing surgery that was common in ancient Inca-land was offered in another paper presented by Dr. Stewart. A skull dug up by Mrs. Alice L. D. Ferguson on her property on the Maryland side of the Potomac, opposite Mount Vernon, has a triangular hole in it, the sharp edges bevelled inward. The bone had healed perfectly. The find is a very puzzling one, because primitive trepanning has not hitherto been known for this part of the continent. Yet the job was so skilfully done that "it would seem unreasonable to expect such a successful end result on a first attempt at cranial surgery."

ITEMS

THE Great Plains region, except for its southwestern end, has enough rain for the first time in years, according to the U. S. Weather Bureau. April rainfall in Montana was double the normal amount, and the excess precipitation in North Dakota amounted to 50 per cent. Grain

crops and pastures are thriving accordingly. Moisture is short in the Southwest and on much of the Pacific slope, but east of the Plains region excessive moisture and low temperatures are holding things back. Effects are felt alike in the cotton, corn and wheat belts.

DANGER of any serious epidemic disease breaking out in Poland and spreading with coming of spring is now believed past, according to James T. Nicholson, of the American Red Cross, who has returned from six months' relief work in German-occupied Polish territory. Food is so scanty, however, that famine threatens this area in the interval before autumn harvest. All winter, Mr. Nicholson states, immunization against typhoid and paratyphoid has been pushed in the area. To prevent typhus outbreaks, de-lousing and other sanitary precautions have been carried on. Disease incidence has been less than normal.

How the United States is attaining national self-sufficiency by its chemical research is shown in the exhibit of the E. I. du Pont de Nemours & Company, which has been redesigned for the World's Fair in New York. Made-in-America materials are displayed which can replace former imports that in times of war may be difficult to obtain. Included in the display were: nitrates, dyes, medicinals, potash, synthetic rubber, optical glass and camphor. A feature of the exhibit this year will be the actual knitting of hosiery made of Nylon fiber.

THAT gas of still unknown chemical composition, given off by moldy lemons, greatly speeds up the production of yellow color on the rinds of sound lemons kept in the same room or container, is reported by Dr. J. B. Biale, of the University of California at Los Angeles. When dark green lemons are exposed to the vapors produced by the mold fungus they color up several weeks earlier than similar unexposed fruits and their respiratory activity is greatly accelerated. There is also a tendency to shed the stem bases or "buttons," and in some cases pitting of the rind has resulted.

A NEW frothy, foaming soap-like germicide that is odorless, non-staining, inexpensive and non-toxic was reported to the meeting of the American Chemical Society, at Cincinnati, by Dr. Robert S. Sheldon, T. J. Becker, M. R. Warren and D. G. Marsh, of the W. S. Merrell Company. The new germ-killing chemical is cetyl pyridinium chloride. Effective against bacteria, it is reported to be relatively non-poisonous to body tissues. Carbolic acid, the well-known germicide, has the handicap of harming tissues in concentrations sufficiently strong to kill bacteria. Moreover, like iodine and mercurial compounds, it is irritating to open wounds. The new germicide can be applied in one per cent. concentrations to the skin without irritation. A 1:5000 concentration can be used safely in the eyes. Another outstanding advantage claimed is that this new compound does not interfere with healing or skin granulation. Clinical uses include treatment of infected wounds and infections of the ear, nose and throat, as a lavage or wash for lungs, nose and throat, and, in surgery, for pre-operative and post-operative sterilization of the skin.

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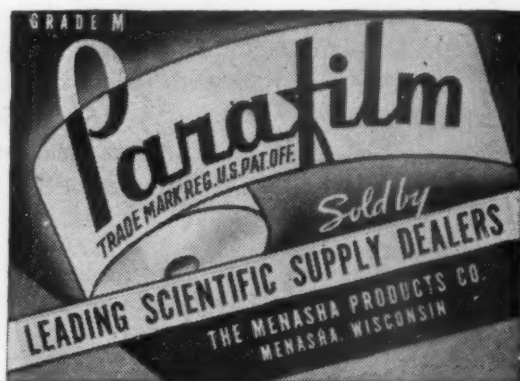
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SCIENCE NEWS

Science Service, Washington, D. C.

PAPERS READ BEFORE THE EIGHTH
AMERICAN SCIENTIFIC CONGRESS

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ASTRONOMY is improving its yardstick of the universe in order to make it a more accurate measure of vast astronomical distances. The improvement may alter some accepted astronomical measurements by as much as 30 per cent. This was the news reported to the Eighth American Scientific Congress, meeting in Washington on May 15, by Dr. Harlow Shapley, director of Harvard College Observatory, the man who first succeeded in providing astronomy with this valuable measuring technique. Essentially the method depends on the so-called "period-luminosity relationship" of Cepheid variable stars, a certain type of star which fluctuates in brightness and derives its name from the constellation in which this type was first found. The relationship first found during a study of the Small Magellanic Cloud, by Miss Henrietta Leavitt, of the Harvard Observatory, in 1912, is simple—the period in which a Cepheid variable dims and brightens is related directly to its intrinsic brightness. Dr. Shapley later found this was true of all Cepheid variables. Thus by studying the period of such a star, astronomers can learn its absolute brightness and by comparing this with its apparent brightness, they can measure its distance. The yardstick has been of tremendous value, for once an astronomer has found a Cepheid variable in a far-off galaxy, he can learn its distance and thus that of the entire galaxy. There are various factors which affect the apparent brightness of a star as observed from this earth, however, which, if not allowed for, render measurements inaccurate. Dr. Shapley has just finished a survey of some 300 Cepheid variables in the Small Magellanic Cloud to learn what these factors are and how to allow for them. One of the important factors, he found, is that the light of a star is absorbed as it travels through this cloud to earth and thus may appear as much as half a magnitude less bright than it actually is. This was the first study of absorption ever made in an outside universe, although astronomers have made many studies of absorption in our own Milky Way. On an average, Dr. Shapley found, a star's light loses about a quarter of a magnitude in the cloud, but, of course, each star must be measured individually. The thickness of a galaxy also affects a star's light (depending on whether it is on the near or far side) and a phenomenon known as "doubling" resulting from two stars in the same line of sight, also affects these observations. Dr. Shapley estimated that because of this absorption and remaining uncertainties in the period-luminosity relation for the longest period Cepheids, the distances of some galaxies may be incorrect by as much as 30 per cent. Relative distances will not be altered appreciably, however; nor do these studies require any major change in the accepted distances of the Magellanic Clouds. He also called attention to the need for more study of the relations between period and luminosity for Cepheids of very short or very long periods, as well as the need for more

dependable magnitude standards in the southern sky where many important studies of external galaxies are being made. To-day's accepted magnitude standards have been established in the northern sky and comparisons of these southern stars involve the risk of a certain amount of error. Dr. Shapley's discussion of this topic was most appropriate for the American Scientific Congress, for the plates from which they were made were taken by Harvard in Peru. He also showed exceptionally fine photographs of a solar eclipse taken in Peru in 1936.

THE electric shock treatment is recommended in certain cases when death comes suddenly following an anesthetic, after an electric shock, or in the heart disease known as coronary occlusion. Dr. Carl J. Wiggers, of the Medical School of Western Reserve University, reported the advantages of his method of restoring the heart beat over drugs such as quinidine and procaine and over the combination of a single electric shock with massage of the heart to start it beating. In the type of cases he investigated death comes suddenly because of a condition known medically as ventricular fibrillation. The French name for it, *insanité* of the heart, describes it very aptly. Ordinarily the many muscle fibers of the heart all contract together in regular rhythm to pump the blood out into the arteries. In fibrillation, the muscle fibers act as individual units. The result is a useless twittering and quivering instead of a strong contraction. When the heart gets the jitters this way, it fails to pump blood out to the rest of the body and death follows swiftly. Strong counter-shock of electricity has been given dogs to stop the useless twittering and get the heart back to its normal rhythmic beating. To achieve the same results in a man, however, the doctor would have to use a current of from 27 to 30 amperes at 2,000 to 3,000 volts. This would be dangerous both to the doctor and to the patient. Weaker currents can be used, and the heart's fatal twittering can be more certainly abolished, if a series of three or four shocks is given at intervals of about one or two seconds, instead of one strong shock.

MAKING food substances (starch and fat) without chlorophyll and in the dark, rated as a biological impossibility by all accepted standards, is a regular performance of a one-celled water organism known scientifically as *Chilomonas paramecium*. Not only that, but *Chilomonas* can make food, grow and reproduce in a solution containing only inorganic materials, according to Professor S. O. Mast, of the Johns Hopkins University. In Professor Mast's experiments, single individuals of this microscopic aquatic species were isolated and kept in bacteria-free drops of water in hollowed microscope slides. Rate of growth was determined by the rapidity of reproduction by division. Starch grains and oil droplets could be seen through the transparent body substance of the tiny creatures. *Chilomonas* can form food in light as well as in darkness, but it was found that starch accumulated in its body more rapidly when it did its work in the dark. It can use organic substances if they are present, but it can

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get along perfectly well with only inorganic salts and carbon dioxide. Increasing the amount of carbon dioxide in the atmosphere in contact with their tiny watery world enables the organisms to produce more food, and up to a certain point also to divide more rapidly. At the highest carbon dioxide concentrations reproduction stopped. Non-reproducing *Chilomonas* individuals, however, were found to be more heavily stocked with starch than the others. *Chilomonas* belongs to the primitive group of organisms known as flagellates, which occupy a position near the bottom of the evolutionary ladder. Botanists and zoologists have sometimes disputed whether they are really plants or animals. They have been known to science for a long time, for they are extremely common. But until now the ability of this animal-like species to do a plant's work and make food out of inorganic substances—and without the supposedly necessary tool, chlorophyll, at that—has not been suspected.

RETURN of rubber production to its native home, the tropical lowlands of the Americas, was advocated by Loren G. Polhamus, of the U. S. Department of Agriculture. Not only would the development of rubber-growing in the warm lands of the New World render this hemisphere more nearly independent industrially of the remote and war-threatened East Indies, but it would be good for the land itself and the people who live thereon. Regions suitable for the cultivation of rubber have heavy rainfall, which endangers the land through erosion if the forests are cleared away and large-scale field crops introduced. To protect the soil, and at the same time to get something commercially valuable out of it, the best things to cultivate are tree crops. Rubber cultivation does not necessarily have to be conducted on huge holdings by the factory-like methods of the great East Indian plantations, Mr. Polhamus pointed out: Many factors favor production of rubber by small holders who are able to take advantage of the use of intercropping which do not interfere with the growth of the rubber tree but which may help to produce a subsistence for the grower. Large expenditures for equipment are not necessary and the small holder need not have the labor difficulties faced by large corporations. The labor of his own family can be used before noon for tapping rubber and after noon for production of food crops. The *Hevea* rubber tree now grown almost exclusively on Dutch and British plantations in the East Indies is a native of tropical America, so that there is no question of its adaptability to New World conditions. It is exposed to plant diseases here, but resistant varieties have been originated and further improvements, both in disease resistance and latex yield, are now being worked on by plant breeders. The *Hevea* rubber tree need not be the sole dependence of American planters, either. There is another species, the *Castilla* rubber tree, that thrives better in the drier, cooler uplands, and it might prove to be the foundation of a rubber-growing industry for the Central American plateau country.

THAT rapid development of agriculture and cattle-raising is going on in the great interior state of Minas Gerais in Brazil, was reported to the congress by A. O. Rhoad, of the U. S. Department of Agriculture. Although it lies

within the torrid zone, the high plateau country of Minas Gerais has a temperate climate due to its altitude, and since railroad and highway development have made it more accessible, settlers have been moving in rather rapidly. The central plateau has always been predominantly grassland. Originally, about 14 per cent. of the area was covered with open forest, but this is being rapidly cut away. Reforestation is not being consistently practiced. Large numbers of eucalyptus trees have been planted, but these are intended primarily for fuel and not for soil conservation.

STEPS taken by the United States to save its western rangelands were described by Richard H. Rutledge, director of grazing service of the Department of the Interior, for the benefit of his South American colleagues. Mr. Rutledge told of over-grazing under pressure of World War and post-war needs, with drought and dust storms that followed. Now, with the danger well realized, federal, state and private agencies are cooperating to conserve the soil, restrain over-grazing, re-grow the lost grass cover, and reforest denuded areas that are capable of growing trees.

A LAND where conservation means just one thing—water conservation—was described in an address by Harold Conkling, deputy state engineer of California. The land is coastal Peru, where there is no rain to erode soil, no forests to preserve, no range problem. The one big job is to find water where there is arable land, and then get the water on the land. Ironically, the four largest rivers that cross Peru's narrow coastal plain must forever waste their water into the ocean, for there is no land worth irrigating near them. Also, it is impracticable to build storage reservoirs in the mountains. Reservoirs are natural ones, consisting of great masses of loose soil and gravel in the valleys, which get filled up with water, sponge-fashion, every year. The water is brought up by pumping from wells between 50 and 200 feet deep. A promising new project, fostered by the Peruvian Government, has in view the diversion of flood waters, now almost entirely wasted.

LOAD the land less heavily. Do not demand such large cash returns from it. Reduce the acreage of plowland, and reduce the intensiveness of cultivation. These are among the steps necessary in treatment of land if civilization is to survive, according to Professor Paul Sears, of Oberlin College. So long as landholders and tax assessors demand the largest possible cash returns from the land, so long will the land thus burdened rebel by losing fertility and yielding to gullying or wind erosion. Modern science has been applied chiefly to elaboration of finished goods to raw materials. It needs also to be applied to the conservation of energy and materials, and to distribution. No sound program of land use and management is possible except on this basis. Wise planning for use-for-survival, rather than misuse-for-profit, can best be accomplished under a decentralized system of control, in Professor Sears's opinion. Regional community control, he feels, will be more flexible and better informed as to the needs and possibilities of the land. The emphasis in such com-

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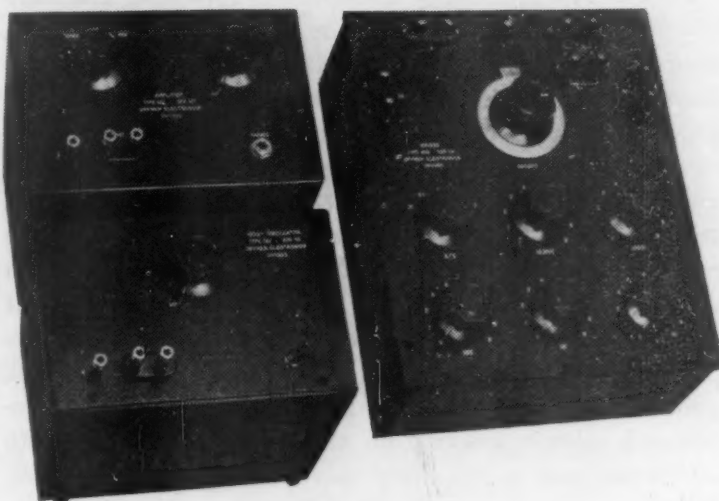
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munities must inevitably be less on profit and more on design.

POLITICAL and military disturbances spreading from the Old World are not the only kinds of shocks against which inter-American preparedness is desirable. Captain N. H. Heck, seismologist of the U. S. Coast and Geodetic Survey, urged a wider cooperative study of earthquakes upon the congress, both for the sake of science in itself and for the practical ends of the protection of cities, canals and other works of man against wrecking wrenches when the earth moves. The long line of mountains extending from Bering Strait to Cape Horn, with sharp drops to great depths just off the Pacific coast, constitutes one of the principal earthquake regions of the globe, Captain Heck pointed out. There are also more limited regions of pronounced seismic activity on the Atlantic sides of both continents and in the interior. For the study of these, North America is now fairly well organized, and the development of a similar web of seismological observatories in Central and South America is regarded as highly desirable.

DR. PEDRO I. AGUERREVERE, of the Venezuelan Geological Service, reported that Venezuela may be the next great oil boom land. What it can do to feed the world's ever-increasing demand for petroleum products will depend in large part not on the development of the oil wells themselves but on what can be done to get the oil shipped. Oil can be shipped out of most important oil fields in Venezuela only as fast as tankers can take it away. At present, a sand bar blocks navigation except at high tide, when just enough shallow-draft tank ships to carry away 500,000 barrels a day can make their way into the harbor. The Venezuelan Government has plans for dredging a deeper channel under consideration, and when this channel is once ready ships will be able to come and go freely, without waiting for the tide. But until that time there is no use in sinking new wells, to produce oil faster than it can be taken to sea. Venezuela has another field, to the west of the one now producing most of the oil in the country. Pipe lines, not yet fully developed, can carry the oil to unrestricted deep-water harbors. Again, transportation is the bottle-neck, but this time it lies in the need for more pipe lines. Nobody knows how much oil still lies undiscovered and untested beneath the soil of Venezuela, but undoubtedly the petroleum reserves of South America are vast. And the known oil fields are within low-cost reach of the sea.

USES of both "practical" and "pure" scientific value have been found for plant roots and other tissue cultures, grown detached from the original parent stock and kept going for long periods in nutrient fluids. Dr. Philip R. White, of the Rockefeller Institute for Medical Research at Princeton, N. J., told the Congress about some of these new uses. One, of considerable immediate importance, is the employment of excised roots as living culture media for mosaic diseases of plants. One such study has already shown that the disease virus tends to concentrate in the middle part of the root fragment, away from both tip and basal end. It has also shown that age rather than

amount of root tissue apparently determines the degree of activity of the virus. In his own experiments, Dr. White reported that he had learned some valuable facts about the nutritional requirements of roots, especially about their use of mineral salts and vitamins. Thiamin, one member of the vitamin B complex, is necessary for root growth, but in exceedingly minute quantities. A solution containing one part of thiamin in a million millions will suffice, under the conditions of his experiment.

VAMPIRE bats have been convicted as carriers of a dangerous form of rabies causing paralysis in livestock, in researches reported by Drs. Juan Iturbe and P. Gallo, of Venezuela. The affected animals usually lose the use of their hind legs; only in two or three per cent. of the cases are the front legs paralyzed also. The causal virus is able to pass through the pores of porcelain filters, and shows a considerable degree of resistance to heat. Heating at 95 degrees Centigrade (nearly boiling) for two minutes does not kill it. Blood-drinking bats carry the virus from animal to animal, but do not themselves develop symptoms of the malady. Such bats fight a good deal among themselves and the infection can be spread from bat to bat in this way. Whether naturally or experimentally infected, bats can carry the virus for a long time in their bodies. Since they are capable of living actively for several days without food, it is possible for the flying animals to carry the disease for long jumps into previously rabies-free territory. Drs. Iturbe and Gallo have succeeded in preparing a preventive vaccine, which has shown encouraging results in the use which has thus far been made of it. They are now at work on a vaccine prepared by another method, from which they hope for even better results.

SNAILS that live on Cuba's mountaintops tell of several times in past ages when Cuba was not the single island with a mountainous backbone that we know to-day, but a chain of smaller islands with channels between the present peaks. How these beautiful and variegated land shells have served as geologic historians was related by Dr. Carlos de la Torre, of the University of Havana, and Dr. Paul Bartsch, of the U. S. National Museum. Cuba is the home of what is perhaps the largest snail family in the world, comprising 355 species and 702 subspecies, Dr. de la Torre explained. Yet there is no doubt that all these originally evolved from a single ancestral form. As the island alternately rose and subsided, the limestone areas that are the homes of these snails were alternately united and separated. During the periods of separation, since interbreeding was impossible, the many distinct forms of to-day came into existence.

A SOUTH AMERICAN animal that is a "non-missing link" between mammals and their reptilian ancestors was described by Dr. Glover M. Allen, of Harvard University. It is a primitive member of the rodent group, known as the paca. In several orders of mammals, scales are present on tails and backs of feet. This is true of rodents, marsupials and ant-eaters. However, in the paca the scales are found on the body as well, with the hairs coming out between them. Dr. Allen described this arrangement as "probably present in early mammals."

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SCIENCE NEWS

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EARTHQUAKE IN THE IMPERIAL VALLEY

THE earthquake in the Imperial Valley, with damage estimated at \$2,500,000, rates as sixth in property destruction among recorded American earthquakes, according to seismologists of the U. S. Coast and Geodetic Survey. Serious as it was, it is dwarfed by such catastrophes as the San Francisco shock of 1906 and the Long Beach earthquake of 1933. The San Francisco disaster accounted for \$24,000,000 loss from direct effect of the earthquake and \$400,000,000 that went up in the fire. The Long Beach quake smashed down property worth \$41,000,000.

Other costly earthquakes in this country have included: Santa Barbara, Calif., 1925, \$6,250,000; Charleston, S. C., 1886, \$5,500,000; Helena, Mont., 1935, \$3,500,000. There have been several quakes of far greater intensity than any of these, for sheer power of earth movement, but they happened in desert or sparsely settled regions and so caused little or no loss of life or damage to property.

The Imperial Valley earthquake apparently resulted from a shift in deeply buried rock fissures that are a southward continuation of the San Andreas fault, which was responsible for San Francisco's ruin a generation ago. This is one of the most actively seismic faults in this country and has been responsible for literally hundreds of earthquakes, some of them quite serious. The exact location of the fault as it runs under the Imperial Valley is not known because it is covered deeply by loose earth and gravel. This unconsolidated material transmits the earthquake movement from the rocks beneath in a way that is extremely destructive to weak buildings, but less damaging to good steel frame and sound reinforced concrete structures.

The last severe earthquake in the Imperial Valley region occurred in 1934 and was centered south of the Mexican border near the head of the Gulf of California. In 1937 an earthquake was felt in the valley, but it originated in the mountains outside, and caused little disturbance. A heavy quake occurred in the valley on January 1, 1927, and was followed by hundreds of after-shocks during the year.

Sunday's shock was recorded on many seismographs all over the United States and Canada. Among them were instruments designed for use at Boulder Dam, now set up for testing in the laboratories of the Coast and Geodetic Survey. The shock was also recorded by instruments of the magnetic observatory at Cheltenham, Md., which are not intended for earthquake study at all.

Two investigators from the San Francisco office of the U. S. Coast and Geodetic Survey, Frank T. Ulrich and Marion Gilmore, arrived in the stricken region early on Monday. Examination of the records of a strong-motion instrument, which had been set up at El Centro, indicated a disturbance of considerable intensity. The automatic pen was thrown off the paper in both directions. Intensity was apparently of violence 9-plus, on a scale of 12 grades of intensity. Records wired to Science Service and interpreted by Coast and Geodetic Survey seismologists indicate that the epicenter was not far from Brawley.

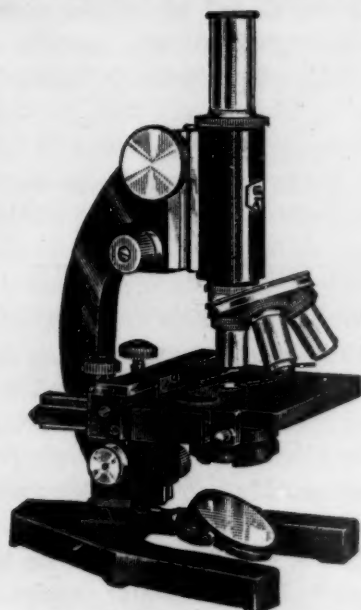
FURTHER PAPERS PRESENTED TO THE AMERICAN SCIENTIFIC CONGRESS

DESTRUCTIVE land uses, like over-grazing and toleration of soil erosion, reach into rivers and lakes to the ruin of fish life. Any plans made for land improvement must include consideration of their possible effects on the nation's fish resources, valued alike for recreational and commercial uses, declared Elmer Higgins, chief of the division of scientific inquiry, U. S. Bureau of Fisheries, speaking recently before the Eighth American Scientific Congress. Exposure of land to rapid erosion, through over-cutting of timber, over-cultivation of sloping areas, over-grazing of pastures, changes rivers from clear to turbid, from cool to warm, and brings on silting-up of lakes. These changes make the waters less fit for habitation by desirable fish like trout and bass and reduce them to the level of "water slums" inhabited only by such fish as carp and mud-cat. Industrial abuses of the waters, especially the discharge of factory wastes and the acid-water outpourings of mines, have made many rivers in this country unable to support even carp. They are not even water slums; they are aquatic deserts. Other misuses of water resources mentioned by Mr. Higgins include neglect to screen irrigation ditch outlets, excessive canalization of rivers, construction of dams with no provision for the passage of fish, drainage of swamps and shallow lakes that afterwards turn out to be unsuited to agriculture, and too-rapid changes in level of lakes backed up by irrigation and power dams. He suggested a program of correction that would permit reasonable use of waters without killing off the fish.

CORN, America's greatest single contribution to world agriculture, has been a botanical riddle ever since its first discovery by Columbus. Its origin is shrouded in mystery; nobody has ever seen a plant that might be its wild ancestor. A widely held hypothesis, that corn is the hybrid offspring between two corn-like grasses, teosinte and gama grass, was disputed before the congress by Professor P. C. Mangelsdorf, of the Texas Agricultural Experiment Station. Teosinte could not be the ancestor of corn, he said, because corn was more probably one of the ancestors of teosinte. In a study of the chromosomes of all three plants he has discovered strong evidence that a primitive type of corn and gama grass formed a natural hybrid, which is teosinte. Distribution of the "wild" teosinte suggests that this happened where the cultivated range of corn came into contact with the natural range of the wild gama grass. The original corn plant, whatever it was, almost certainly grew in the Andean region, in the Texas geneticist's opinion. Indians found it good for food in its wild state, better after they had cultivated and improved it. From the South American highlands it spread from tribe to tribe, until it was grown in practically all parts of the Western Hemisphere where soil and climate would support it.

SOUTH and Central America, original homes of the potato, have lately been combed for new varieties to be bred with European and American stocks already in use, for the

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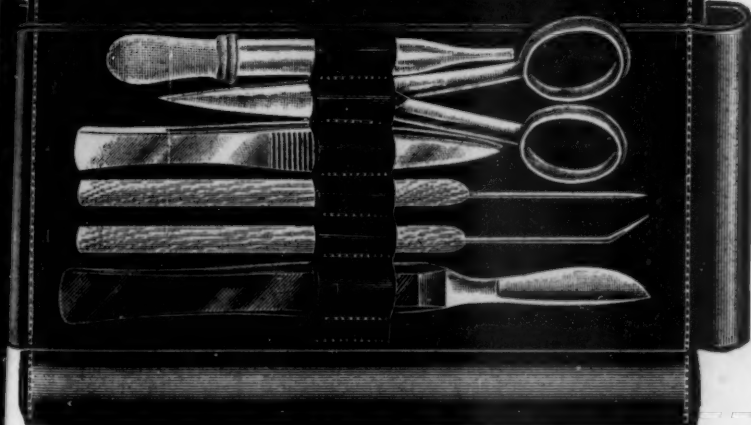
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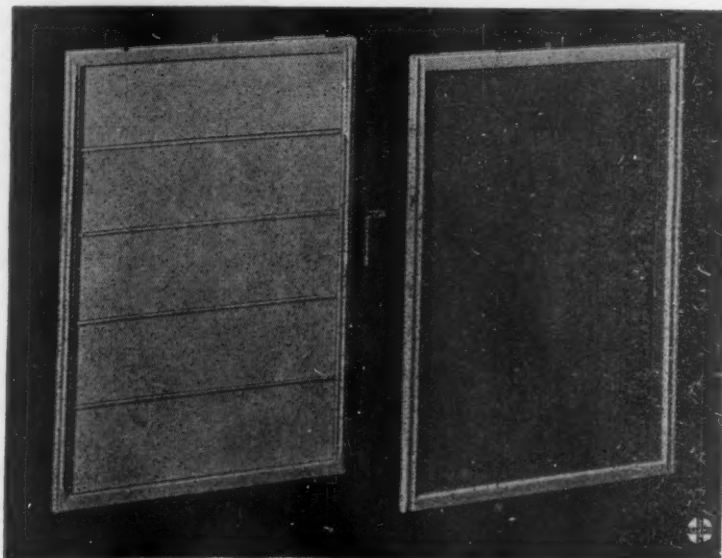
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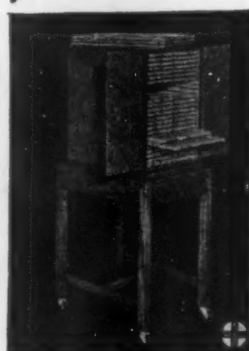
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production of better-quality hybrids, according to Edward K. Balls, leader of an expedition sent out under the auspices of the Imperial Agricultural Bureau of London. The work of the expedition was confined mainly to the western slopes of the Andes, through Colombia, Ecuador, Peru, Bolivia and northern Argentina. Best hunting was found around Lake Titicaca in southern Peru and northern Bolivia, where about 200 forms were obtained, many of which were known to Indians long before the coming of white men. In all, planting material representing about 500 different species, forms and varieties was brought out by the expedition.

DR. HENRY K. SVENSON, of the Brooklyn Botanic Garden, stated that plants of the Galapagos Islands are mainly of South American mainland origin, despite earlier beliefs that they were endemic, or as peculiar to the islands as the giant tortoises and sea-going lizards that fascinated Darwin a century ago. The islands have only a single genus, a woody relative of the daisies and sunflowers, that is not found in any other part of the world. All the rest of the plants have kindred elsewhere. Three modes of transportation have been used by plants in clothing the islands, which are geologically relatively new, with vegetation. Some may have drifted in by sea, borne on the Humboldt current which sweeps over from the western shore of South America. Spores of ferns and mosses, and the lighter kinds of seeds, could come in by air. Finally, of very late date, came the introduction of plants by human agency, either of cultivated plants that have escaped and run wild or of weeds brought in unintentionally.—FRANK THONE and JANE STAFFORD.

VITAMINS

VITAMIN K, which is saving desperately sick adults and new-born babies from bleeding to death, may go in the next "U. S. Pharmacopoeia." This book is sometimes called the druggists' Bible. It is the legal standard for drugs in the United States. If a drug or a vitamin or a hormone is labeled U.S.P., it must conform to the standards of preparation, purity and strength set by the Pharmacopoeia. Preparations for the twelfth "U. S. Pharmacopoeia" (they are issued every 10 years), are being made.

Riboflavin, a member of the large family of B vitamins and recently reported effective in treating the sometimes blinding eye disease, keratitis, may also be included in the next edition. Some of the new sex hormones also are likely to be included. A strong note of international co-operation was sounded as the convention got under way in the midst of renewed war activity in Europe. Dr. E. Fullerton Cook, chairman of the Revision Committee for the decade 1930-1940, pointed out that the "Pharmacopoeia" must be planned to meet the needs of people in all parts of the world. This has been done to some extent already, as in the case of chaulmoogra oil, used in treating epilepsy, which was introduced into the "Pharmacopoeia" to meet the needs of the Philippines and other Oriental countries. Other nations have their own pharmacopoeias and a dozen or so of these were on display, including the German, the Dutch, the Finnish, the Russian and one from far-off Thailand.

The care and the work involved in determining standards for U.S.P. products appeared in the story of the standardization of cod-liver oil. The work began with one of the scientists personally selecting the fish livers from the cod fish catch to be used in preparing the oil. Here is a new phrase picked up at the convention for those addicted to talking about their operation: "Chorda Chirurgicalis U.S.P." Translation is "surgical gut" or "surgical catgut." This means that for the first time the surgeon can sew up wounds with a U.S.P. product, because standards for surgical sutures have now been included in the "Pharmacopoeia."—JANE STAFFORD.

PARKINSON'S DISEASE

(Copyright, 1940, by Science Service)

REMARKABLE changes in patients suffering from Parkinson's disease treated with Vitamin B₁₂ administered intravenously, effective within a few minutes after the treatment, were reported by Dr. Tom D. Spies, of Hillman Hospital, Birmingham, Ala., at the 100th annual meeting of the Illinois State Medical Society.

Parkinson's disease, called also paralysis agitans, is a shaking palsy, marked by muscular weakness, stiffness and pain. Its treatment has hitherto been considered more or less hopeless. Dr. Spies and his colleague, Dr. William B. Bean, treated 11 cases of at least four years' duration, eight of which were arteriosclerotic and three of which were post-encephalitic. Upon the cases following encephalitis vitamin B₁₂ produced the most remarkable results. A few minutes after the injection there was marked improvement. Tremor and rigidity decreased. The patients were able to walk without customary stiffness. Two of the arteriosclerotic patients showed definite improvement, five were unchanged and one was considerably worse.

Dr. Spies also reported that Dr. Norman Jolliffe, of the New York University College of Medicine, in a personal communication has stated that he has obtained similar results following administration of vitamin B₁₂ to patients with Parkinson's disease.

Temporary relief of neuromuscular symptoms, roaring sensations in the ears, anorexia and insomnia in selected persons with malnutrition was obtained through use of another synthetic vitamin, alpha-tocopherol, or vitamin E, the so-called fertility vitamin, was also reported by Dr. Spies. These patients were badly nourished but gave no evidence of pellagra, beriberi or riboflavin deficiencies.

Last year Dr. Spies reported that vitamin B₁₂, then newly synthesized, produced dramatic, 24-hour recoveries of patients with pellagra and beriberi that recurred when they lived on their old inadequate diets.

SEVENTEEN-YEAR LOCUST

BILLIONS of 17-year cicadas, longest-lived of all insects, will be emerging from the earth soon over the greater part of the country between the Mississippi and the Atlantic coast, to fill the warm air with their shrillings throughout the month of June. They have lived underground for 17 years, sucking juices from the roots. Those emerging now will mate, produce their eggs and die, and the tiny grubs that hatch from the eggs later in

the summer will dig into the earth to repeat the same strange, hidden life cycle.

The heaviest outbreaks this season are expected in the Tennessee and upper Ohio valleys, with outlying groups ranging from northern Illinois to Cape Cod, and south along the Appalachians into the northern counties of Georgia. This year's crop of 13-year cicadas, southern cousins of the 17-year species, probably will be exceedingly scanty.

There are 17 broods of the 17-year cicada and 13 broods of the 13-year kin-bug, so that every year there are some of them in one part or another of the country east of the Great Plains area. Some of these broods are large and widely distributed, as in the case this year; others are few and scattered, as will be the case in 1941, 1942 and 1943.

The periodical cicada is an insect with a body about the size of the end joint of your little finger, and large, thin, transparent, prominently-veined wings. Near the tip of each wing is a brilliantly orange-colored marking shaped like the letter W, which local prophets always interpret as a sure sign of war. This year's broods come as rather tardy prophets.

Cicadas can neither sting nor bite, so that it is perfectly safe to catch and handle them. The male insects (which are the only ones that sing) will even oblige with a solo as you hold them: you can see the little tympani in the sides of their bodies vibrating rapidly.

The insects are practically harmless to vegetation, since their mouthparts are so feebly developed that they can not feed. The adults live on food stored in their bodies, mostly in the form of fat, during their month or so of above-ground life.

The only mischief they do is to the green twigs of trees, mostly oaks, into which the females thrust their eggs in long rows. Such twigs usually lose their leaves and die, but as a rule cause no permanent injury to the trees. Only when wholesale egg deposition takes place in young orchards or tree nurseries is there any real cause for complaint.

The first white man's observation of 17-year cicadas was recorded in a book printed at Cambridge, Mass., 1669, describing an outbreak that occurred around Plymouth in 1634, as "a numerous company of flies . . . they came up out of little holes in the ground, and did eat up the green things, and made such a constant yelling noise as made all the woods ring of them, and ready to deaf the hearers."—FRANK THONE.

ITEMS

THE advent of low-cost "health" lamps emitting ultra-violet light rays has spurred paint manufacturers to develop paint for walls of rooms which will reflect a large amount of these beneficial radiations. Ordinary paint usually reflects less than ten per cent. of the ultra-violet light which falls on it so that the walls of the ordinary room are merely "traps" for the ultra-violet light which comes from the new lamps. D. F. Wilcock, working in the Basic Science Laboratory of the University of Cincinnati, has developed white interior finishes which now reflect up to 72 per cent. of the ultra-violet light, making it possible to have indirect health ray light for a room.

A SPECIAL ointment to protect the hands of hosiery mill workers without damaging the silk hose they work on was devised by a druggist called in consultation on this industrial health problem. Ordinary ointments or lotions protected the skin of the girls' hands from the strong alkaline solutions with which the raw silks were treated. The fats or oils of these ointments, however, damaged the silk, causing serious losses. The pharmacist, called in consultation by a skin specialist, made up a protective ointment of the vanishing cream type, containing no oil, but with enough acid to neutralize the strong alkaline base used in treating the silk.

IMPROVED ways of dehydrating castor oil so that it can be used as a carrier for paint pigments was reported by F. G. Bessler and J. C. Weaver, of the Sherwin-Williams Company, Cleveland, Ohio, at the Cincinnati meeting of the American Chemical Society. Until recently it was difficult to change the sticky, non-drying castor oil into a pale drying oil by removing part of the water. Drs. Bessler and Weaver reported success in using the dehydrated castor oil to produce rapid drying, high quality finishes without the use of tung oil or perilla oil. Tung oil comes mainly from China and perilla from Manchuria. Excellent color durability is secured by research which seeks to free the United States from the risks of importing much of its paint-drying oils obtained from distant lands now in war zones.

A RECORD of no diphtheria deaths during an entire year has been achieved by thirty-two cities in the United States, according to reports from the local health officers to the American Medical Association. These cities are: Akron, Albany, Canton, Des Moines, Duluth, Elizabeth, Erie, Fort Wayne, Grand Rapids, Kansas City, Kans., Long Beach, Lowell, Lynn, Milwaukee, New Bedford, New Haven, Paterson, Peoria, Portland, Rochester, Scranton, Somerville, South Bend, Springfield, St. Paul, Toledo, Trenton, Utica, Waterbury, Wichita, Yonkers, Youngstown. Some of these cities have had no diphtheria deaths for one or more previous years. Utica, N. Y., leads the honor roll, with no deaths from this cause reported in six years. Decreases in the diphtheria deathrate from all sections of the country are reported and are said to reflect the intensive anti-diphtheria campaigns carried out by health officers with the cooperation of family physicians.

IF sulfanilamide treatment of gonorrhea does not show signs of curing the patient within five days, this chemical remedy should be stopped and another method of treatment started, Dr. P. S. Pelouze, of Philadelphia, declares in a report to the American Medical Association. Sulfanilamide alone "will bring about a prompt cure in from 25 to 40 per cent. of dispensary patients, from 45 to 55 per cent. of office patients and, perhaps, from 75 to 85 per cent. of bed patients," Dr. Pelouze states in his report on treatment of gonorrhea in men. Even in cases it does not cure, sulfanilamide used early in the disease, he said, "almost invariably makes it a milder disease thereafter and enormously reduces the likelihood of serious complications."

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SCIENCE NEWS

Science Service, Washington, D. C.

THE MOBILIZATION OF SCIENCE

AMERICA'S research power, as important as a national defense measure as the actual army, air force and navy, is being surveyed quietly for possible mobilization of science, as a national resource or in any emergency.

For the past few months a staff of specialists with headquarters in the building of the National Academy of Sciences in Washington has been marshalling facts and figures about just where in this nation new scientific knowledge is being sought. Leading scientists of wide acquaintance in their circles are hard at work making detailed reports and evaluations so that Uncle Sam, in peace or war, may know just where to turn when he has a puzzling scientific question to ask.

Government bureaus and university research centers, as well as industrial laboratories, are being tapped freely to produce a real census of American scientific effort. The survey was requested by the government and it is being made with federal funds, although the actual conduct of the survey is in the hands of a committee of the National Research Council, which is itself a part of the National Academy of Sciences.

Broader than a mere military preparedness measure, this research survey obviously will be of increasing usefulness as preparedness efforts are intensified.

Even if the United States escapes the actual blight of war, there are many problems of a constructive nature to which science and research can make a major contribution.

Major emergencies in the past, beginning with the Civil War or the War Between the States, brought a marshalling of science in aid of the national effort. The National Academy of Sciences was established by the Congress partly as a war measure when Lincoln was president. Out of the World War came the National Research Council, perpetuated when peace came as a national clearing house for science. When in 1933 an economic emergency arose, President Roosevelt formed a Science Advisory Board to advise the government. The National Resources Planning Board under the New Deal has given major attention to science and research. All these agencies would be expected to participate in any further mobilization of science as a part of the preparedness program.—WATSON DAVIS.

THE NATIONAL HEALTH

(Copyright, 1940, by Science Service)

A PROGRAM for national defense on our most vital and vulnerable front is presented by Paul de Kruif, in his book, "Health Is Wealth," published by Harcourt, Brace and Company.

The present threat of war does not lessen the need for enactment of a national health program. This is clear from the report of Colonel Lloyd B. Magruder, U. S. A., recruiting officer of the second corps area, that 32 per cent. of the young men volunteering for Army service in May had to be rejected as physically unfit and that 60 per cent. of those volunteering from urban centers will have to be rejected for health and other reasons.

Tanks and guns and planes can not defend a nation by themselves. Men are also needed, men whose strength has not been sapped by "hidden hunger," whose hearts have not been crippled by rheumatic fever in childhood, whose lungs have not been damaged by tuberculosis. A program for the health of the nation is part of a program for its defense. The cost of such a program, as presented by Mr. de Kruif, will save money in the long run by cutting the nation's bill for hospitalization of the mentally sick, the tuberculous, the crippled and for support of their families. Enough might even be saved to pay for part of the cost of the defense program now under way.

In war or peace, however, we need also to protect the first of those rights with the weapons of the specialist: toxoid to defend life against diphtheria, sulfapyridine and serum to defend life against pneumonia, the surgeon's knife and x-rays and radium to defend life against cancer, vitamins to defend life against the "hidden hunger" starvation. To guarantee these rights to every American, we must push our program for national health.

The program Mr. de Kruif presents is not likely to meet with opposition from the American Medical Association. It was drawn up by five Michigan physicians, three of them, Dr. Henry A. Luce, Dr. Thomas K. Gruber and Dr. L. G. Christian, members of the House of Delegates of the association, and the other two, Dr. Henry R. Carstens and Dr. A. S. Brunk, officials of the Michigan State Medical Society. All the features of a health program for which the American Medical Association has fought, maintenance of the doctor-patient relation, lack of regimentation of doctors, provision for high quality of medical care, administration by a federal Department of Health, are provided in this national health program. It has the approval of Dr. Thomas Parran, Surgeon-General of the U. S. Public Health Service.

It may even be the means for a burying of the hatchet between the government and the American Medical Association. This is strongly hinted in the section of the book describing the attitude of Supreme Court Justice Frank Murphy when, as attorney general in charge of the government's suit against the American Medical Association for violation of the Sherman Act, he was presented with the program and in turn helped to arrange for its presentation to President Roosevelt.—JANE STAFFORD.

THE WORLD PRODUCTION OF TIN

(Copyright, 1940, by Science Service)

THAT the United States has purchased 6,724 tons of tin since last November to build up a reserve stock pile of this strategic material, is shown by a survey of U. S. Treasury Department Procurement Division orders.

Despite the total of over 13,000,000 pounds at about 50 cents a pound valued at \$6,500,000, the reserve is believed to be only about a tenth of the total needed reserve of the nation. Army officials are reluctant to discuss exactly what tonnage of tin the nation would like to have for potential war reserves, but some years ago the National

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Resources Board fixed 60,000 tons as a minimum war-time reserve.

Last year the Straits Settlements produced nearly 31 per cent. of all the virgin tin in the world while Netherlands India produced 17 per cent. It is a significant comment on world production that the American purchases since November of last year have been virtually all from the Orient. Minor contracts have been awarded for Bolivian tin. Bolivia produces 15 per cent. of the world output, not in the form of pure tin but as tin concentrates which run from 70 per cent. to 80 per cent. tin content. This concentrate has to be further refined; an operation carried out mainly, in the past, in England and in the Netherlands. It is understood that two tin smelters are contemplated in the area of New York harbor to take over the smelting of Bolivian tin.

Tin has long been on the strategic minerals list of the United States, for American production has amounted to only about 90 tons a year, over a five-year average. The nation's requirements, on the other hand, run to nearly 100,000 tons yearly, of which about 75,000 tons must be virgin metal. The remainder consists of secondary tin obtained from scrap which collects in tin-can factories and from "junk" alloys which contain tin.

Prize tin region of the world is of course the East Indian colonies of England and the Netherlands. In this region the tin ore is cassiterite, or tin oxide, which runs as high as 78.6 per cent. tin. Mining is a simple operation by dredges, of which more than 100 are available. In addition anywhere from 50,000 to 100,000 Chinese laborers work at tin mining, according to the world demand.

THE EARTHQUAKE ANALYZER

Most persons, when an earthquake is once over, have no desire to repeat it, but the seismologists, who study such tremors scientifically, often want a return performance, so as to study the movements that took place. This, in effect, can be done with the new earthquake analyzer developed by Professor Arthur C. Ruge, of the Massachusetts Institute of Technology. It was described recently before the meeting in Cincinnati of the eastern section of the Seismological Society of America at Xavier University.

In many places, especially California, where earthquakes are likely to occur, "strong motion" earthquake recorders have been placed in strategic locations. The ordinary seismographs, which respond to tremors thousands of miles away, are so delicate that they can not record the effects of a local quake. The strong motion instrument lies dormant until one happens in its vicinity, then it goes into action. Dr. Ruge now has available for study such records of about 40 earthquakes, including the disastrous one at Long Beach, California, in 1933, which killed 120 persons and caused damage to the extent of \$50,000,000.

With the earthquake analyzer, the wavy lines in the record are scanned by an electric eye, and are transformed into a series of electric impulses. These are fed into a galvanometer, which has a swinging mirror, adjusted to vibrate with the same characteristics as any desired building or other structure. Thus, the swaying of such a building may be measured by recording, on a moving strip of

photographic paper, a spot of light reflected by the mirror. The characteristics of the swinging mirror are changed with another photo cell, or "electric eye," and can be adjusted by turning the control dials.

Professor Ruge expressed the opinion that the device will find other applications, such as analyzing rainfall or sun-spot records, or for solving difficult vibrational problems of the mechanical engineer.

HIGH OCTANE GASOLINE

GASOLINE of high octane rating, the advantages of which have been widely advertised, is no cure-all for the ills of motor car performance, according to C. H. Van Hartesveldt and H. W. Field, of the Atlantic Refining Company, who spoke before members of the Division of Refining of the American Petroleum Institute, meeting at Fort Worth, Texas.

"When high-octane-number gasoline is used in a car which does not knock on the lower-octane material, no improvement in performance results," they stated, "and when a car that knocks is fueled with a high-octane gasoline, the knock is reduced, but no additional power or gasoline mileage is obtained unless the knock was extremely loud. For power loss the knock must be so loud that no motorist with normal hearing, driving such a car, would fail to take the car to a repair shop. These things have been known for some time, but they deserve more emphasis than they are getting in present-day advertising."

Messrs. Hartesveldt and Field urged that gasoline quality be measured by performance in cars rather than laboratory tests, which means that technical difficulties make it impossible to expect the success of recent legislative efforts to fix gasoline quality. They declared that "an increased cost of \$5 a year for a motor vehicle, if used to pay for mechanical adjustments and tune-up of the engine, would result in greater owner satisfaction than this same amount of money spent in furnishing a higher-octane gasoline."

Any advantages in reducing engine knock obtained with high-octane gasoline is appreciably reduced when anti-freeze is used, was reported by Herschel G. Smith, of the Gulf Oil Corporation. "Water is a more effective coolant, due to better heat transfer from the cylinder walls, than any known anti-freeze compound." He suggested that, with engines equipped with thermostatic control on the cooling system, for best performance a setting should be made for control at a lower temperature when anti-freeze is used than with water alone.

The odor of gasoline gives no clue either to its performance or to its corrosiveness, said John Happel and S. P. Cauley, of the Socony-Vacuum Oil Company. For this reason they urged the elimination of tests now made for foul-smelling compounds called mercaptans. "The average gasoline consumer is much more conscious of factors governing gasoline performance than of the more superficial specifications which were considered significant in the past. He recognizes the importance of such items as mileage, freedom from knocking, satisfactory starting and warm-up. Just as the introduction of colored gasolines resulted in the abandonment of rigid color specifica-

sons, so the relatively small number of cases in which the consumer is in a position to be affected by gasoline and militates against this item being of major importance in gasoline quality."

THE HIT-AND-RUN DRIVER PROBLEM

(Copyright, 1940, by Science Service)

A PLAN for solving the problem of the hit-and-run driver was presented by Dr. Lowell S. Selling, psychiatrist of the Recorder's Court, Detroit, Mich., at the meeting in Cincinnati of the American Psychiatric Association.

A study of some fifty hit-and-run drivers brought to the Detroit court gave Dr. Selling information as to the mental state of a hit-and-run driver and from this he evolved his plan for solving the serious problem they present.

Almost half of the hit-and-run drivers (twenty out of the fifty) had unstable psychopathic personalities. A second important group were feeble-minded, and another group was made up of neurotic persons who had infantile reactions and feelings of inferiority.

Dr. Selling concluded that "any mental deviation is likely to result in fleeing from the scene of the accident." His recommendations for solving the hit-and-run driver problem are:

1. The feeble-minded should be highly trained and coached if they are to drive at all.
2. The psychoneurotic should not be permitted to enter an automobile when in a highly unstable or upset state.
3. Persons with a bad background who are improperly equipped mentally or physically for driving should be especially warned and their problem must be dealt with in psychiatric fashion.
4. Potential traffic offenders, and these are all growing people, should be diagnosed and treated by other clinical means before they reach the age where they will commit a hit-and-run offense.—JANE STAFFORD.

ICE-AGE ANIMALS

WHAT exactly were the first prowling, lumbering and charging beasts that early man entering from Asia had to face and slay?

A scientist on the trail of Ice-Age animals figuring in the dawn chapter of American history, some 25,000 years ago, is Dr. E. H. Colbert, of the American Museum of Natural History.

No dinosaurs, of course! The popular notion that enemy number one of early man was a "r'aring" dinosaur dies hard—harder than the dinosaurs did. The last unlamented dinosaur passed on some 80,000,000 years ago. Compared to that, man is a youngster, with possibly a million years to his "past."

But first hunters to roam America's wilderness, late in the Ice Age, had to face a circus of large and formidable beasts. No modern circus can boast any of these species.

Surely present when man arrived in the New World, Dr. Colbert concludes, were woolly mammoths and mastodons, clumsy giant sloths and giant beaver, wild horses and camels. Bison, too, were plentiful, though of a different species from bison shot by later Indians.

Among those "probably" present, Dr. Colbert lists

giant tapirs, peccaries, saber-tooth tigers and an ancient form of jaguar.

After sharing the wilderness with man for a while, the wild creatures of that age vanished. Man may have helped them along to extinction, Dr. Colbert suspects, not only by his hunting, but by more effective exterminators, such as diseases or pests. When they died off suddenly has not yet been discovered. And Dr. Colbert says rather pessimistically, "We may never know why these animals became extinct."—EMILY C. DAVIS.

ITEMS

ACCORDING to a survey of crop weather by the U. S. Weather Bureau, May was a month of little rain. In this it contrasts sharply with April, which in some sections of the country was decidedly a wet month. Even in the Southeast, however, where April was on the dry side, May also brought deficient rainfall. The one area where there was really heavy rainfall during the last week of May was where rain was most needed. There were falls of as much as four inches in portions of Arkansas, Texas and southeastern Oklahoma.

THE disastrous earthquake of Friday, May 24, in Peru, centered very close to the shoreline, probably on the sea bottom a short distance off Callao, seaport of Lima, the Peruvian capital. Seismologists of the U. S. Coast and Geodetic Survey, after studying reports wired to Science Service, gave a provisional location as in latitude 12 degrees south, longitude 78 degrees west. Time of origin was 11:33.8 A.M., E.S.T.

THE Montana State College Observatory, under the direction of Professor Eric Therkelsen, reported no less than four earthquakes. In addition to the Peruvian disturbance, there were others at 6:52 and 10:58 A.M. and at 5:00 P.M. None of these three has yet been located.

SEISMOLOGISTS of the U. S. Coast and Geodetic Survey stated, after studying instrumental records from a number of North American observatories, that a strong earthquake shock rocked the uninhabited wilderness near the Alaska-Canada boundary just south of the Arctic Circle early on Tuesday evening, May 28. The epicenter was located approximately in latitude 68 degrees north, longitude 139 degrees west. This is in the headwaters of the Porcupine River, about 50 miles east of the boundary. The region is usually considered non-seismic, or free of earthquake liabilities. Exact time of origin was 8:57.6 P.M., E.S.T.

TINCTURE of iodine as an antiseptic for cuts should be used in the first instance, leaving mercurochrome to the physician. This advice was given, in effect, by Dr. Leonard J. Piccoli, professor of pharmacology of Fordham University and American Red Cross first aid instructor, at the Richmond meeting of the American Pharmaceutical Association. Tincture of iodine, his laboratory studies show, is at least three times more powerful as an antiseptic than the aqueous solution of mercurochrome found in most first aid kits and in family medicine chests. The 2 per cent. acetone-alcohol solution of mercurochrome used by physicians, however, is relatively as efficient as tincture of iodine.

THE SCIENTIFIC MONTHLY

J. McKEEN CATTELL, F. R. MOULTON and WARE CATTELL, Editors

CONTENTS FOR JUNE

THE SOCIO-BIOLOGY OF MAN. PROFESSOR M. F. ASHLEY-MONTAGU.

SCIENCE AND CULTURE. LAWRENCE K. FRANK.

A SERPENT-SEEKING SAFARI IN EQUATORIA. I. ARTHUR LOVERIDGE.

SUNLIGHT AND PLANT LIFE. DR. EARL S. JOHNSTON.

ON THE ROCK-STRUCTURES AND PLANTS OF OLD RAG MOUNTAIN, VIRGINIA. DR. TITUS ULKE.

ORGANISM, SOCIETY AND SCIENCE. III. PROFESSOR R. W. GERARD.

HOSPITALS AND THE ADVANCEMENT OF SCIENCE. DR. CHARLES E. REMY.

BLUE JAY: BRIGAND OR BENEFACTOR? PROFESSOR ARNOLD GESELL.

GENERAL FORMAL EDUCATION BY FIELD OF EMINENCE. DR. MAPHEUS SMITH.

BOOKS ON SCIENCE FOR LAYMEN:

Samples of Science; Are Mental Disorders Increasing?; Present and Future of Television; Shell Collector's Handbook.

THE PROGRESS OF SCIENCE:

The Annual Meeting of the National Academy of Sciences; The American Association Meets in Seattle; Progress in Harnessing Power from Uranium; Is Atomic Power at Hand?; The Milky Disease vs. The Japanese Beetle.

INDEX.

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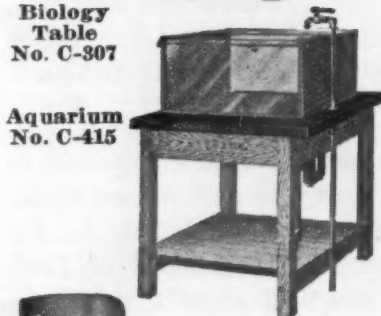
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SCIENCE NEWS

Science Service, Washington, D. C.

CHEMICAL ELEMENTS HEAVIER THAN URANIUM

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DISCOVERY of a whole new group of chemical elements heavier than number 92, uranium, which the text-books now list as the heaviest, has begun through the positive identification of element 93 and the probable discovery of element 94 at Berkeley, Calif.

The research, which was carried out by Dr. Edwin M. McMillan, of the University of California, and Dr. Philip Hauge Abelson, of the Carnegie Institution of Washington, confirms the discovery made several years ago by Professor Enrico Fermi, of Columbia University, of element 93.

When in January, 1939, the sensational splitting of uranium atoms with release of power was discovered, the existence of element 93 was called into question. Dramatically this happened at about the time that Professor Fermi received the Nobel prize for his researches. Now Professor Fermi's discovery is vindicated, and the discovery at Berkeley of still another super-heavy element is indicated. It is expected that the discovery of element 94 of atomic weight 239 will be reported in an early issue of the *Physical Review*.

Theoretically this new element 94 might be converted by self-destruction or radioactive emission of a helium nucleus into the uranium of atomic weight 235, which is sought as source of atomic power, but, surprisingly, this new element 93 is very stable. There is no likelihood that it can be used in the manufacture of the power-producing uranium.

Here is the train of events in the sub-microscopic world of the atom that gives rise to the new heavy-weight elements:

Starting with the common sort of uranium 92 of 238 atomic weight, this element is bombarded with relatively feeble neutrons of 25-volt energy. One of these is captured by resonance and the ordinary uranium becomes radioactive, with a half-life of 23 minutes. This produces element 93 of atomic weight 239. This is the element discovered by Professor Fermi.

The new element 93 is itself unstable and is radioactive, half of it disintegrating every 2.3 days. The existence of this reaction was first noted but not identified last year by Dr. E. Segre, a former colleague of Professor Fermi's at Rome, working at the University of California.

Now the McMillan-Abelson research indicates that with emission of electrons the element 93 changes to element 94 of the atomic weight 239.

Thus two elements heavier than uranium are added to the periodic table of the fundamental building blocks of the matter of the universe.

The discovery of other heavier elements may be expected as research progresses. For example, element 95 is being sought. The relative stability of element 94 among elements that are all radioactive brings hope that the others will be identified.

If the element 94 of 239 atomic weight gave off an alpha particle or helium atomic nucleus of weight 4, it would be converted into the power-emitting uranium 235. But preliminary explorations are understood to have indicated a very long life time for element 94, perhaps many thousands of years, making highly improbable any possible production of uranium 235 by this means.—WATSON DAVIS.

FREQUENCY MODULATION RADIO

WITH frequency modulation radio, known as FM, given the green light by the Federal Communications Commission, the stage is set for rapid changes in radio—provided war does not freeze the present art and prevent progress.

Within the next five years, radio engineers are freely predicting that almost every large broadcasting station now operating will be paralleled by an FM station, probably carrying the same program. There will be many local stations serving limited areas that will operate on FM alone.

Within a few months or a year all the larger radio sets will be built to receive both the more ordinary amplitude modulation signals and FM. FM broadcasts can not be received on conventional radio sets. Thousands and perhaps millions of sets in the next few years will be manufactured and purchased, as FM broadcasting grows. Elimination of static, extraordinary fidelity of tone, and lack of interference from distant stations are features of FM.

When the FCC cleared the radio spectrum from 42,000 to 50,000 kilocycles for FM it was a triumph for a kind of radio that many said could not be produced, the invention of Major Edwin H. Armstrong, of Columbia University, father of important radio circuits used in almost all ordinary radio sets in use to-day.

Dominant radio broadcasting interests did not take kindly to a new kind of radio, although there was much more interest on the part of manufacturers of radio sets who saw a chance to fill a demand for more sets.

Radio typewriters, in homes and business offices, pounding out news in the same way that it comes over teletypes in newspaper offices, may be a by-product of FM. Or a facsimile service can be broadcast. Either of these services can be multiplexed or carried on the same wave band as the sound FM without any interference. Whether they will be available will depend upon whether the public wants these services sufficiently to pay the price of the rather costly and complicated receivers.

FM quality will be only as good as the receiver that catches the radio signal and converts it into sound. While much conventional radio broadcasting does not run the whole gamut of the spread of sound frequencies, most receivers are much more woefully deficient in their frequency ranges. For instance, the broadcast frequencies of transmitters often range from 60 to 10,000 cycles per second, while many receivers range only from 150 to 5,000.

THE WORLD'S WHEAT SUPPLY

(Copyright, 1940, by Science Service)

Is the world being drawn toward famine?

This dark question haunts the food experts, who soberly admit they can not see far ahead in this continually surprising war. But reports from the world's food front, that mean bread, or none, for large masses of the world's two billion people, are not bright.

There is hunger now in parts of Europe, hunger in northern China. The United States, more fortunate, sees no menacing shadow of food shortages on its own horizon.

At the start of Europe's war, the world's granaries overflowed with largest wheat supplies known in history. The 1939 crop, plus record-breaking reserves, totaled the tremendous amount of 5,459,000,000 bushels, not counting the wheat in Soviet Russia and China, for which available figures are never complete. Now, the wheat situation is less favorable. Wheat, which means bread to a third of the world, has been attacked by severe winter in northern Europe and by a late spring, shortage of field labor, devastation in embattled countries. The crop is forecast as less than needed for consumption.

Meanwhile, ironically, the reserve that was record-breaking in 1939 is apt to be about 250,000,000 bushels larger than in July, 1939, when it stood at 1,189,000,000 bushels. A large part of this reserve is in the hands of the Big Four wheat-exporting countries—Australia, Canada, the United States, Argentina. Shipping and financing limit the amount that can be exported now. By another July, in 1941, the carry-over will be on the down grade, it is believed. Oddly enough, the Wheat Advisory Committee, back in 1938, forecast the carry-over of the world's wheat to be expected in the summer of 1940 at 1,369,000,000 bushels, which is close to the reality, though that forecast was based on an assumption of "normal conditions."

The saying of World War days, "wheat will win the war" may be heard again if strife spreads and lengthens. Germany's recent invasions have damaged crop prospects of lands that never produced enough grain for themselves at best. The United States in an ordinary year would expect to send 80,000,000 bushels of wheat to Belgium, the Netherlands, Denmark and Norway. Feeding 20,000,000 Belgians, Dutch and Danes next winter is a problem that Germany faces. And Germany's conquests have not yet brought her major grain resources to meet her own needs.

Reports of the world's wheat future include these:

Japan's wheat crop is now expected to be 24 per cent. less than the official estimate, due to adverse weather and not enough fertilizer supplies.

Finland lost quantities of grain in the ceded area, and found its imports of grain from Scandinavia cut off, when war broke out there. Finland expects a shortage of grain next winter.

France has the burden of 5,000,000 refugees, with the Red Cross as the only stop-gap aid in meeting the problem.

North China has been faced with hunger, and latest reports of the wheat crop there are conflicting, some encouraging, others not.

A bread-basket land like Hungary is rationing its flour.

The United States' wheat crop is forecast a little smaller than last year, amounting to 489,000,000 bushels of winter wheat, 215,000,000 bushels of spring wheat and a carry-over in July, 1940, of about 288,000,000 bushels.

Spain, which spent a grim winter, with some towns going two days at a time without bread, has another scant cupboard to look forward to. The wheat yield is forecast at 20 per cent. below normal, due to scarcity of fertilizers, poor agricultural machinery and low acreage. Spain offers a preview of what other lands enduring war can expect.—EMILY C. DAVIS.

SOME PAPERS READ BEFORE THE AMERICAN MEDICAL ASSOCIATION

(Copyright, 1940, by Science Service)

THE layman's divided interest to-day between national defense measures and measures for giving him better medical care was reflected in the report to the American Medical Association, which opened in New York City on June 10, under the presidency of Dr. Nathan B. Van Etten, of New York.

Patriotism and a desire to uphold organized medicine in its squabbles with the government and unofficial reformers were blended in his address.

Dr. Van Etten believes that America's doctors are threatened by "pagan" invasion not only with guns but with ideas which would force foreign systems of medical practise on them. He said: "Love of country is a noble passion, but loss of the strong position of organized medicine in the United States would be deplorable and in the midst of this excited moment we must not lose sight of our patriotic ideals for the health and happiness of our people. We must not lose sight of the dangers to medical practise through concentrations of federal authority."

He approved the President's plan for medical service through small hospitals, but said they should be "workshops for ordinary physicians sufficiently educated to take care of average patients who will make up the average tenantry of these institutions." For patients needing more expert care, he suggested ambulance service to carry them to larger hospitals in larger towns.

Members of the house of delegates to whom he was speaking will bring discredit to the group which make the policies of the association, he stated, if they do not know exactly the medical needs of their own communities.

A POWDER extracted from human body fluid which gave encouraging results in treatment of sixty stomach ulcer patients was shown. The remedy was developed by Dr. David J. Sandweiss, Dr. M. H. F. Friedman, Dr. H. C. Saltzstein and Dr. A. A. Farbman, of Wayne University College of Medicine and Harper Hospital, Detroit. The substance, still unidentified, not only cured experimental ulcers in dogs but actually prevented their development. The patients who have been treated with this new substance have not been followed long enough, nor have there been enough of them to be sure that a cure has been found.

THE only hope for saving the lives of a third of the older patients having massive bleeding from stomach ulcers is prompt operation, Dr. John H. Blackford and

Dr. Robert H. Williams, Seattle, concluded from a study of the records in the city bureau of vital statistics of patients who died of stomach ulcer. Among 23,965 deaths they found 116 which could be attributed to hemorrhage from ulcer. More than 97 per cent. of the group were over 45 years old and 78 per cent. of them died from the first hemorrhage.

PATIENTS with acute appendicitis should be given the benefit of immediate operation rather than be given the so-called delayed or expectant treatment, according to Dr. Edward S. Stafford, Baltimore. An analysis by himself and Dr. David H. Sprong, Jr., of the mortality among 1,317 patients operated on for acute appendicitis at the Johns Hopkins Hospital between September 1, 1931, and September 1, 1939, has convinced these surgeons that the patient has a better chance of surviving when operated on immediately. Dr. Stafford pointed out that surgeons know that death "seldom follows the competent removal of an acutely inflamed, but unperforated appendix." Arguments presented against the delayed treatment are: (1) The most experienced surgeon can not always tell accurately whether an appendix has ruptured; (2) even if the patient recovers from the attack, he still has his appendix and is in danger of another attack.

THAT a pill or tablet can be swallowed to give protection against scarlet fever was announced by Dr. George F. Dick and Dr. Gladys Henry Dick, Chicago. The tablet contains purified scarlet fever toxin such as is now used to give immunity by injections under the skin. The tablet is designed for use in patients who can not be given the injections. Such patients include those suffering from hemophilia, for which a hypodermic needle injection may mean dangerous bleeding; patients with severe heart injury, and persons in institutions under quarantine for scarlet fever when speed in immunization is a prime consideration.

SUCCESS of a new drug, thio-bismol, in helping the fight against brain syphilis, or paresis, was reported by Dr. Harold N. Cole, of Cleveland. The new drug controls the fever of malaria which is now being widely used in treatment of this form of syphilis. By means of this bismuth compound, the chills and fever can be kept from becoming too severe without stopping the malaria treatment altogether. For terminating the malaria quinine must still be used. Collaborating with Dr. Cole in the trial of the new drug were Dr. Gerard A. DeOreo, Dr. James A. Driver, Dr. Herbert H. Johnson, of Cleveland, and Dr. Walter F. Schwartz, now of Pasadena, Calif.

SULFANILAMIDE is an efficient remedy for one type of the distressing skin disease, impetigo, but not for the other, Dr. Stephan Epstein, Marshfield, Wis., said in announcing that there are two types of this malady. One type is caused by streptococcus germs, and for this sulfanilamide is an efficient remedy. The other type is caused by another germ, the staphylococcus, against which sulfanilamide is less, if at all, effective. The staphylococcus type predominates in the Middle West, Dr. Epstein finds, while the streptococcus type is more common in the East and in Western Europe.

AIR conditioning may be the future treatment for patients with mental and nervous disorders, it appears from a report by Dr. William F. Petersen, of the University of Illinois, and Dr. Hans H. Reese, of the University of Wisconsin. Without advocating such treatment, these investigators found that changes in weather have such influence over the mental state of patients as well as the moods of normal persons that vague difficulties or emotional disability may be augmented into full-fledged mental illnesses.

ITEMS

SHOOTING stars, or meteors, seem all to be permanent members of the solar system, according to Dr. Fletcher Watson, of the Harvard College Observatory. He finds that previous measures of their speeds, which would have brought some in from outer space, were too great.

INVESTIGATIONS of cosmic rays provide a way to study the conditions of the upper atmosphere of the earth at extreme heights, it has been demonstrated at the Institute of Physical and Chemical Research and the Central Meteorological Observatory in Tokyo. It has been found that cosmic ray intensities fluctuate with different air mass conditions over Japan. Warm air masses high in the stratosphere tend to decrease the intensity of the cosmic rays.

TUBERCULOSIS will be wiped out by the year 2000, Dr. Henry D. Chadwick, of Waltham, Mass., president of the National Tuberculosis Association, predicted at the first general session of the convention of the association in Cleveland on June 3. His prediction was based on the way the tuberculosis death rate has been dropping during the twentieth century. Assuming that the average decline of approximately one third every ten years can be maintained, Dr. Chadwick said: "In that event, the tuberculosis death rate would be 32 in 1950, 21 in 1960, 14 in 1970, and 40 years from now in 1980 a rate of 9 or 10 may be anticipated. The bells that ring in the year 2000 may sound the death knell of the tubercle bacillus. The ultimate surrender of the tubercle bacillus" may come sooner than in two generations, as a result of discoveries in chemical remedies and nutrition.

THE miracle of making little children walk again when wasted, useless muscles had apparently doomed them to life in a wheel chair has been accomplished in five cases by treatment with vitamins E and B. Details of the cases are reported by Dr. Simon Stone, Manchester, N. H., in the *Journal of the American Medical Association*. One of these children was a victim of infantile paralysis. Wasted muscles and pain in both legs made it impossible for her to stand alone or to rise from a lying to a sitting position. After she was helped to her feet she could walk, but with unsteady painful gait. Vitamin B—all members of the group—banished the pain and enabled her to walk without support. But her muscles remained wasted. When vitamin E, in the form of wheat germ oil, was added to the vitamin B treatment, her muscles were restored to nearly normal usefulness within one month, her limp greatly improved, and no sign of muscle wasting could be detected.

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SCIENCE NEWS

Science Service, Washington, D. C.

THE NATIONAL ADVISORY COUNCIL

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A SPEED-UP of science and research applied to national defense is getting under way with the appointment of Dr. Vannevar Bush, president of the Carnegie Institution of Washington, to head President Roosevelt's new National Defense Research Committee. Although the new committee is only a few days old, it is expected to coordinate and in some cases merge efforts already in progress.

Numerous universities and industrial laboratories have volunteered their services, and preliminary contacts and plans have already been developed with Army and Navy officers charged with accelerating the defense plans and procurement.

It is known that a survey of aircraft production has been underway for several months under the auspices of the National Research Council with funds provided by the War Department. Since Dr. Bush is chairman of the National Advisory Committee for Aeronautics, the government's important research agency that has contributed largely to aviation's rapid advance, it is felt that the aviation aspects of research are more advanced than research applications in some other fields. Psychological and other tests of airplane pilots is another research application that a National Research Council committee has been working upon for several months.

The new National Defense Research Committee is expected to have assigned to it by military authorities many other such problems. Working in all probability from the magnificent building of the National Academy of Sciences and the National Research Council just across the street from the Army and Navy buildings, the new committee will undoubtedly call upon research groups in industries or universities that are equipped to solve the difficult problems that arise in strengthening our military forces.

Of special value to the new committee will be an industrial research survey and a revised directory of industrial research laboratories just being completed by a committee after a half-year's work. This will allow the location of competent research workers with special knowledge and training needed to meet any special demand.

There has also been discussion of the registration of all scientists for defense service, not only so that the best men and women can tackle the problems to arise, but so that those having special training will not be wasted as ordinary soldiers in the event of a draft. Such a plan was carried out in Great Britain.

Washington, even before the formal announcement of the new National Defense Research Committee, was beginning to become the clearing house for research activity. Several leading scientists from universities have been conferring with Army and Navy officials, among them Dr. Edward C. Tolman, who heads a special council created by the California Institute of Technology to cooperate with the government in defense plans.

The new National Defense Research Committee is the

fourth major group called into existence to aid the government in times of emergency. The National Academy of Sciences was created by Congress at President Lincoln's request during the Civil War and it has continued as a "senate" of science, election to which is one of the highest honors in American science. The National Research Council was created during the World War as a government agency and continues to-day as a part of the academy. The Science Advisory Board was appointed by President Roosevelt in 1933, made effective reports on scientific research by the government and then went out of existence. Now the National Defense Research Committee is formed to play its part in the present situation.—WATSON DAVIS.

EDUCATION OF THE DEAF

CELEBRATING fifty years of success in teaching deaf people to talk—not to be "deaf and dumb"—and launching a more determined crusade to make the deaf still more nearly inconspicuously normal, the American Association to Promote the Teaching of Speech to the Deaf held its annual meeting in Providence, R. I., from June 17 to 21. The birthday celebration will honor Dr. Alexander Graham Bell, of telephone invention fame, who created the organization.

As an encouraging demonstration that even marvels achieved by the deaf-blind Helen Keller, may be exceeded, two doubly-handicapped pupils will exhibit their skill in conversing. Leonard Dowdy, twelve-year-old deaf-blind student at Perkins Institution for the Blind has amazed educators by his ability to place a hand lightly against cheek or neck of a speaker and to understand speech by the vibration thus felt. Miss Keller "listens" by placing fingers against the speaker's nose, lip and chin. Leonard's rapid progress in acquiring language and his delight in skating, skiing and other strenuous sports have impressed teachers, who believe he may set new records for his handicap in attaining a happy and normal life. His partner in the demonstration will be a deaf-blind girl pupil, Carmela Otero, of the same school.

To teach more parents to help their deaf children, the new idea of daily classes for parents at the meeting will be tried. The classes are an outgrowth of the Correspondence Club for Parents, which the association maintains. By a managed plan, about a hundred parents send round robin letters in groups of ten, thus sharing experiences with other families of deaf children as far afield as Vancouver, Cuba, Mexico and South Africa and Australia. It is estimated that about 10 per cent. of parents of deaf children have the time and ability to apply knowledge gained through this experience exchange.

Five generations of the family of Dr. Alexander Graham Bell were represented. A memorial fund, providing prizes for teachers of the deaf, is in honor of his father, Professor Alexander Melville Bell, the best known elocutionist of his time. Three living generations of the family took personal part in the celebration.

Historic papers in which Dr. Bell and his deaf wife advocated that the deaf be taught to use their voices and to read the lips of others, were read by their grandson, Melville Bell Grosvenor, and their granddaughter, Mrs. Barbara Fairchild Muller. An award for the best essay by a deaf pupil on Alexander Graham Bell and his influence on teaching the deaf was presented to the winner, Arthur Coy, of Providence, by Dr. Bell's daughter, Mrs. Gilbert Grosvenor. A Golden Birthday Fund of about \$4,000 and a birthday book inscribed with the names of contributors will be presented by Gilbert Grosvenor, 2nd, great-grandson of Dr. Bell and accepted by Mrs. Calvin Coolidge, honorary president of the association. The fund is expected to aid the organization in its effort to bring the deaf into normal, active association with hearing people.

A CYCLOTRON FOR THE UNIVERSITY OF ILLINOIS

AMERICA'S sixteenth cyclotron will be built at the University of Illinois. The new machine will be rated at 10,000,000 to 30,000,000 electron volts acceleration. An older Illinois cyclotron is rated at 1,000,000 volts. The new cyclotron will be somewhat smaller than any of the fifteen others now in operation or under construction, but roughly equivalent to any in results. It will send out atomic particles at speeds of 20,000 to 40,000 miles per second. That is more than one tenth the speed of light. A cyclotron is used for studying the composition of matter by smashing atoms. It is also used in the production of artificially radioactive substances. These are used in research in physics, chemistry and biology.

Professor P. Gerald Kruger, who built the university's small cyclotron in 1936, also is in charge of the new machine. Its bulkiest part will be an electromagnet with a 60-ton iron core. The magnet will be wound with two miles of copper bar which will weigh 10 tons. It will be supported on a 37-ton concrete foundation.

Construction will take at least a year. The machine will cost \$31,500. Radiations from it will equal those from 300,000 grams (600 pounds) of radium, which would be worth, if it existed, \$6,000,000,000, nearly equal to the value of all the homes, personal property, and passenger automobiles in the State of Illinois.

Professor Kruger spent the last half of 1939 working at the Berkeley laboratory of Professor E. O. Lawrence, of the University of California. There Professor Kruger studied the effect of cyclotron-bombarded materials upon cancer. This study may lead to new treatment for the disease.

Working with Professor Kruger in building the new cyclotron at the University of Illinois are Professor J. R. Richardson and Dr. E. M. Lyman.

THE TREATMENT OF LEUKEMIA

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OPTIMISTIC progress in combatting chronic leukemia was announced at the meeting of the American Medical Association in New York. A better method of treating patients with this invariably fatal ailment was reported by Dr. William P. Murphy, of Boston, who shared the

Nobel prize in medicine in 1934 for his work leading to the liver treatment for saving patients with pernicious anemia.

Dr. Murphy has not succeeded in curing leukemia, but he reports that with the treatment he has developed patients live a little longer and much more comfortably. The women in his series of cases were able to continue with household duties, one of the men continued his ministerial duties, and most striking of all, perhaps, a bus driver who had arthritis as well as leukemia was able, after treatment for both conditions, to do hard labor for three or four years without undue fatigue.

The treatment that Dr. Murphy advised fellow physicians to adopt consists in "spraying" the body with small doses of x-rays from a distance. X-ray treatment has long been used for this condition, but the rays have generally been directed in large doses to the spleen and bone marrow, where blood cells are formed.

Leukemia is characterized by excessive numbers of white cells in the blood. The intensive x-ray treatment has usually made the patients so miserable with nausea and loss of appetite and weakness due to sudden decrease in number of white blood cells that they usually dread the treatment and wait until they are in desperate condition before taking it. Smaller doses of x-rays given more frequently and by the "spray" technique over large areas of the body is not so hard on the patient and controls the disease better. The frequency of treatment should be determined by blood tests and the patient's general condition.

Chronic leukemia, he believes, results from a lack of some substance necessary for the maturing of white blood cells or their origination in much the same manner as pernicious anemia results from a deficiency of some substance concerned in red blood cell production. This is shown by the way in which the white cells respond to x-ray treatments of small dosage. The deficient factor in leukemia is supplied in some manner by the x-rays in small doses, probably less satisfactorily by large doses which may also destroy cells.

DEFICIENCY OF VITAMINS

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DR. TOM D. SPIES, of Birmingham, Ala., pointed out at the meeting of the American Medical Association that war may be causing famine in Europe, but that here in America, even without war, there is a chronic famine. The chronic famine we have here is a starving for vitamins, minerals and other precious substances found in minute amounts in foods. Large numbers of people are starved for these substances, partly because they do not eat enough of the foods containing them and partly because foods as they come to the table to-day have lost much of their normal content of these protective substances.

About 90 per cent. of the vitamin B₁, preventive of beriberi, in bread has been lost from the flour in the milling process. Water soluble vitamins are also lost to us by being washed out of the soil, so that plants do not furnish enough of these to the animals and men that live on them.

Dr. W. H. Sebrell, of the U. S. Public Health Service,

stated that death figures do not show the extent of this chronic famine in America. This, partly, is because deaths from this cause are not all recorded as pellagra or scurvy or beriberi deaths. Partly, too, it is because this famine does not kill, although it keeps people ailing and miserable and unfit for work. It is estimated that at least 100,000 people are probably suffering from pellagra.

For a more complete picture of the extent of the vitamin deficiency in the country, Dr. Sebrell turned to figures on consumption of vitamin pills and similar preparations. In 1937 the people of the United States spent more than \$100,000,000 for vitamin preparations manufactured or sold through pharmaceutical channels. Perhaps not all of this vast amount of vitamin-taking by the people was necessary to stave off vitamin famine or repair its ravages. The sum of \$26,000,000, however, was spent on vitamins prescribed by physicians. "A figure of this magnitude," he explained, "must mean that physicians are becoming increasingly aware of the value of the preparations in treatment and, conversely, that vitamin deficiency symptoms are widely prevalent." The figures on vitamin consumption are probably much higher, because in 1937, latest year on which figures are available, neither nicotinic acid nor riboflavin were being widely used. "Prevention and proper treatment of the nutritional diseases constitute one of the greatest medical problems in this country to-day."

THE PREVENTION OF DIABETES IN DOGS

THAT the first steps toward prevention of diabetes have been made through medical research workers, among them Dr. C. H. Best, of Toronto, was stated by Dr. H. F. Root, of Boston, speaking before the meeting of the American Medical Association.

The disease has actually been prevented in dogs. This prevention has been accomplished in two ways. It depends on the discovery that diabetes can be caused either by failure of the insulin-producing part of the pancreas or by overwork of this insulin factory in the pancreas. In dogs this overwork is due to stimulation of the insulin-producing cells by injections of an extract from the pituitary gland in the head. Insulin given at the same time as the pituitary extract, however, prevents the diabetes. It can also be prevented by fasting the dog before the pituitary extract is given.

If the diabetes is allowed to develop under pituitary stimulation, giving insulin allows the overworked insulin factory in the body to rest and renew or regenerate itself. This regeneration of insulin-producing cells occurs in human beings also. The star-shaped cells called mitotic figures, which are signs of rapid regeneration of body tissue, have been discovered in the insulin-producing part of human pancreases.

Many people, he pointed out, are on the border of diabetes. If these persons get pneumonia or a bad tonsil infection, they will be tipped over the border because the infection caused too much strain on their insulin factories. With the right treatment and diet, however, they can be helped to recover from their diabetes. Their insulin-producing cells may regenerate as do those of the dogs studied.

New synthetic sex hormones are helping women with

diabetes to have babies successfully, according to Dr. Priscilla White, of Boston. Loss of babies by diabetic mothers has been cut in half since treatment with these hormones was started two years ago. The hormones used are called stilbestrol and pranon.

Not every expectant mother with diabetes needs this treatment. Blood tests can now be made, however, to show whether the diabetes is severe enough to upset the glandular balance of the mother's body and so cause her baby to be born so far ahead of time that it can not live.

ITEMS

THE human body, like industry, uses iron over and over, according to investigators of the U. S. Department of Agriculture, Washington, who are studying the body's need of this essential element. Iron is used in the red blood cells. As these cells break down, about 85 per cent. of the iron is recovered and returned to the bone marrow. In the whole body there is only enough iron to make an oversized shingle nail.

EXAMINING the mysterious skull of a young woman, found in a jar where it was placed after being severed from her body, 5,000 years ago in India, Dr. Wilton M. Krogman, of the University of Chicago, suggested that the modern Mediterranean race may once have had a mixture of Negroid blood, since eradicated by out-breeding. The young woman, who may have been a princess, sorceress or priestess, to account for the strange preservation of her head, came to light during excavations of the Boston Museum of Fine Arts at Chanhudaro, India. No other ancient skull of India has ever been brought to the United States. Dr. Krogman stated that if the skull had been assembled from odd parts, it could not present a more conflicting picture. He concluded that it combines such Negroid traits as flattened head vault, broad nose opening and low eye sockets, with Caucasoid features such as narrow nasal bones, small teeth, moderate distance between the eyes and shape of palate. He pronounced the ancient woman of India "a proto-Mediterranean type in which ancestral Negroid traits have manifested themselves."

SNATCHING from the laboratory a dancing mirror to render more faithful reproductions of phonographically recorded sound, a new sound system for home and commercial phonographs has been introduced by David Grimes, chief engineer of the Philco Corporation. Instead of the conventional needle of the ordinary phonograph, a feather-weight sapphire floats along the groove of the record. The recorded sound is translated into minute bobbings of a paper-thin aluminized mirror, such as heretofore has been used only in galvanometers and oscillographs of research laboratories. A tiny beam of light from a specially made lamp plays on the mirror, which reflects it to a small photoelectric cell, creating in the cell an electric current that corresponds to the sound variations on the record. Amplified and reproduced in a loud speaker, this current gives a high degree of faithfulness with a minimum of scratch. Since the motion of a needle in the record's groove does not need to bear down heavily to set up mechanical or crystal vibrations, it is claimed that the life of the record is increased at least ten times. Needle changing is eliminated.

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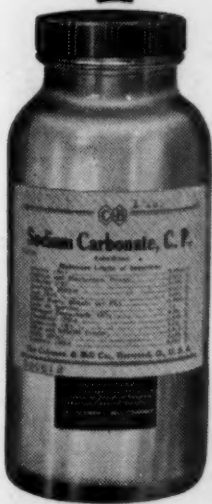
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SCIENCE NEWS

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THE RATE OF COOLING AT A LUNAR ECLIPSE

If the surface of the moon were covered with a layer of lava about an inch thick, its rate of cooling at a lunar eclipse would be explained. Reporting on observations made from Mount Wilson Observatory on October 27, 1939, when the moon entered the earth's shadow, Dr. Edison Pettit, of the observatory staff, draws the following conclusion:

The measurements were made by a thermocouple, which changes the heat radiation from the moon into electricity. It was attached to a 20-inch reflecting telescope. These showed that at the beginning of the eclipse the temperature of a point on the lunar surface where the sun was directly overhead was 208 degrees F., just below the boiling point of water on earth. While the moon was entering the shadow, the temperature dropped rapidly, so that when the eclipse was total, the temperature was 98 degrees below zero, F. While the moon was in the shadow, the temperature continued to drop, rapidly at first, then more slowly, until just at the end of the total eclipse, it had reached 144 degrees below zero, F. As the moon left the shadow, the temperature returned to normal.

From these data, Dr. Pettit was able to calculate the ratio between the radiation that the moon receives, from the sun, and that which it sends out again into space. He found that the two were nearly proportional, showing that the moon's surface is able to hold its heat for a very brief period. This is characteristic of materials like volcanic lava, of which the moon's surface is supposed to be made. Knowing how lava does "hold its heat," he found that a layer 2.6 centimeters (about one inch) thick would respond in the way the moon's surface did on this occasion. These results are similar to observations which he made of a lunar eclipse in 1927. Dr. Pettit's report will appear in the *Astrophysical Journal*.

STEREOSCOPIC MOVIES

PRESENTATION in the home of stereoscopic movies that show full relief are made possible with a new invention by Edwin H. Land, of Boston, and Joseph Mahler, of Nemecky Brod, Czecho-Slovakia. For it they have been granted United States Patent No. 2,203,687.

Mr. Land is the inventor of polaroid, the film that causes light passing through it to vibrate in a single plane, instead of in all directions, as it does ordinarily. This has previously been used for stereoscopic motion pictures; for example, at the New York World's Fair, where visitors to one building can see three-dimensional movies of an automobile being assembled.

To do this, the pictures are taken with a two-lens camera, one lens recording the view as it would appear to an observer's right eye, the other as it would look to his left eye. With two projectors, or a single projector using an attachment in which the light is divided into two beams, these pictures are shown together on the same screen. To the naked eye, they are hopelessly blurred.

To avoid this, polarizing films are placed over the projecting lenses, so that one image, say that for the right eye, is formed of light vibrating up and down, the other of light vibrating from side to side.

When a member of the audience is provided with special polaroid viewing glasses, these are separated. Over the right eye is placed a film that passes only up and down light, while the one for the left eye admits side to side vibrations exclusively. The pictures are sorted out, and each eye sees only its proper view, as it would at the original scene.

The new invention, however, allows such movies to be shown with an ordinary projector, either of the theater or home type, without any special attachment, other than the viewing glasses used by the audience. For still pictures, special lantern slides can be used in an ordinary magic lantern.

The two pictures are superimposed on a single film. Each image is itself formed in a polarizing layer, by destroying the polarizing properties over a limited area corresponding to the picture. Thus, when projected on a screen, the parts of the picture that both eyes should see are formed of unpolarized light. This, naturally, goes through either viewing lens. The part of the picture that one eye should see is made of polarizing material set to the proper direction of vibration for that eye. For the blacks in the picture, where neither eye sees any light, both layers retain their full polarizing effect. Having their planes of transmission at right angles, no light passes through these parts.

The patent specifications suggest a number of methods by which the polarizing properties of the films may be destroyed to produce the images. Some are with chemicals, others make use of the action of light or other radiations. Gradations of light and shade in the picture may be obtained, it is claimed, by only partially depolarizing the layers. Further, the pictures do not need to be projected, but may be made as prints, still requiring the use of the viewing glasses.—JAMES STOKLEY.

"SUN-BATHING" THE BLOOD

A NEW method of treating blood poisoning and other dangerous infections including childbed fever, claimed to be superior to treatment with sulfanilamide or other chemicals, was announced at the meeting of the American Medical Association by Dr. George Miley, of Philadelphia.

The method consists, essentially, of "sun-bathing" the patient's blood. The sun-bathing is done not by the sun's ultra-violet rays themselves, but by artificially produced ultra-violet rays. A measured amount of blood, the amount depending on the patient's weight and condition, is taken from his veins and after ultra-violet irradiation of from nine to fourteen seconds is put back into his veins. The irradiation is done as the blood is put back. This method of treating infection has been attempted before, but did not succeed until development of a special chamber in which a system of baffles keeps the blood turbulent while

the ultra-violet rays are hitting it. Credit for development of this device, Dr. Miley said, belongs to E. K. Knott, electrophysicist of Seattle, Wash. The demonstration was the first announcement before a large medical group of the results with the new device.

Out of 27 patients with severe infections 22 recovered. These patients had blood poisoning due to various kinds of germs, including staphylococcus and streptococcus. Within 24 to 48 hours their temperature dropped to normal and stayed there. All the women with childbed fever given this treatment recovered. In these cases, the germs had not invaded the blood. Dr. Miley has taken the treatment himself and reported that neither in his case nor in any others were there any bad effects on the blood or on kidney function.—JANE STAFFORD.

SOIL EROSION PROBLEMS IN INDIA

SOIL erosion, that world-ranging dragon that eats the farmer's fields, has its raking teeth deep in the crowded, heavy-burdened land of India. Recent comments on the problem by Dr. R. MacLagan Gorrie, the well-known Indian agronomist, have a familiar ring to American ears:

"The destruction wrought by a modern war heals over quickly compared with the disaster of erosion. Poppies bloom on the old Flanders battle fields, but a leafless desert remains in the wake of our itinerant goat herds.

... It is a crime for any village to possess land which can be classified as 'waste.' Every piece of land, no matter how poor it may be, can produce at least a good grass crop which can be cut and harvested."

Soil conservation efforts in India are conditioned, as they are everywhere else, by the existing systems of landholding and land use. In India, most farms are very small, so that the appeal of the soil conservationist must be made to the individual owner or tenant, to make his particular bit of soil a self-contained rain catchment area.

Non-agricultural land, especially grazing land in forests, presents some peculiar problems. Dr. Gorrie calls attention to the fact that erosion can become very serious even under a tree canopy, if trampling herds range through it, stripping the grass and beating the bare earth hard. The recommended remedy is to cut down the number of cattle and better their quality, keep them in stalls and feed them on cut grass instead of letting them out to graze. Despite the innate conservatism of the native cultivators, some success in this program is already reported.—FRANK THONE.

THE ROBOT LOOKOUT FOR FOREST FIRES

A ROBOT lookout, to keep watch for forest fires, is the newest scientific aid designed for forestry. The device is the invention of Serge N. Koulichkov, and is protected by U. S. Patent No. 2,177,493. Its possibilities will be discussed in the forthcoming issue of the *Journal of Forestry*.

The robot fire lookout consists of a combination of a photocell or electric eye, designed to respond to a rising smoke column on the horizon, and a highly sensitive thermocouple, similar to those used by astronomers in measuring the minute quantities of heat radiated by distant stars. The thermocouple will catch the glow from a far-off fire. Only when the photocell and thermocouple

report both smoke and fire will the apparatus sound the alarm, notifying a distant operating station by radio or wire connection.

The apparatus has its limitations. As designed at present, it will tell of the presence of a fire within its range of vision, but it lacks the judgment supplied by a human observer in sensing the actual location of fire, and the degree and direction of its spread. It will therefore probably not replace human observers, but may prove useful as a supplement to their vigilance.

Housed in a small rotating turret mounted on the mechanism that keeps it constantly turning to sweep the horizon, the robot lookout would cost about \$500 to produce on a quantity basis. Since this is approximately the cost of maintaining a human lookout on a fire tower for approximately three months only, the use of the apparatus seems to promise both economy and increased efficiency in forest fire fighting.

PAPERS READ BEFORE THE AMERICAN SOCIETY OF MAMMALOGISTS

THAT the high crowns of horses' teeth may have been due to constant and rapid wear of their ancestors' dental equipment, was suggested by Dr. R. A. Stirton, of the University of California, at the recent meeting in Denver of the American Society of Mammalogists. He pointed out that "wide-spread sandy deposits, together with appearance of bunch grass, and increasing aridity, may have been important factors" in the development of the unusually long teeth characteristic of modern horses. Primitive horses that lived in America when the climate of the West was more humid, had more generalized, lower-crowned teeth. That horse-tooth development occurred in this way can not be proved, but "the possibility should be given additional consideration."

SHORT is the life-span of the smallest American mammals, the shrews; as short as the natural lives of many of the insects on which these hungry little carnivorous creatures prey. Study of more than 600 specimens of the smoky shrew has convinced Dr. William J. Hamilton, Jr., of Cornell University, that this species normally lives less than a year. The smoky shrews do not breed during the year in which they are born. Following the breeding season in their second summer, when the adult shrews are from 9 to 11 months old, they all die, usually in August or September. The responsibility of keeping the species in existence over winter is thus left to immature animals. This appears to be true of other species in the genus studied by Dr. Hamilton.

THAT wood rats increase immensely in numbers in overgrazed rangeland was reported by Dr. Walter P. Taylor, of the U. S. Biological Survey. When livestock kills off the grass and other desirable forage by eating it too closely, such western weeds as cholla cactus, mesquite and catclaw increase. These are the preferred food of the wood rat, which thrives as the weed population thrives. Dr. Taylor opposes a general wood rat killing campaign on the open range. It would, he declared, do no appreciable good to range forage. "On the other hand, it would distract attention from the real cause of most diffi-

culties encountered in the arid country, namely, too many livestock for the actual carrying capacity of the range."

PRAIRIE dogs are far more numerous in the West than they were before white men and cattle replaced Indians and bison, according to Dr. Taylor. The increase in prairie dog population is due at least in part to the reduction in average height of grasses on the range, the result of heavy grazing. Prairie dogs like a wide horizon. They will not live in high-grass formations where their little sentries can not see possible danger approaching from afar. But when over-grazing cleans out the tall and mid grasses, short species come in. Heavy grazing by livestock results in other changes in the wild animal population. Increases occur in numbers of ground squirrels, kangaroo rats, coyotes, bobcats, certain hawks and owls, jackrabbits and plague grasshoppers. Disappearance of the tall grasses causes a decrease in the animal populations that liked the shelter and food they provided, such as cottontail rabbits, meadow mice, harvest mice and cotton rats.

THE toughest bobcat, the "orneriest" coyote, the most temperamental skunk, can be carried off alive in a common gunnysack if you only use the right methods, according to Vernon Bailey. First, of course, you must catch your bobcat, coyote or skunk. This must be done with a trap that does not cause the excessive pain that always comes with the savage grip of the old-fashioned steel trap. Mr. Bailey has invented several types of painless traps that nevertheless hold even more securely than the old steel-jawed kind. When you approach a trapped animal to bring it back alive, move slowly, talk softly to it, handle it carefully and gently. Slip an ordinary gunnysack over it, trap and all. Then remove the trap from the captured foot, tie the mouth of the sack shut and hoist it on your shoulder. That's all there is to it. When securely tied up in sacks the animals think they are hidden. They are quiet while being carried over your shoulder or in a car and generally can be transported for short distances more comfortably than in boxes or crates. Clean sacks, free from dust and well ventilated, should be used. If the weather is warm they can be dampened and kept in circulating air for the comfort of the occupants. Dr. Bailey showed two reels of motion pictures illustrating his technique of painless, scareless handling of trapped animals.

PHOTOGRAPHING THE VOCAL CORDS

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In photographing vocal cords of singers at a speed of 4,000 pictures a second, Dr. John C. Steinberg, of the Bell Telephone Laboratories, has discovered that a trained singer's vocal cords are closed much longer during the vibration cycle than is the case with untrained voices. This prolonged closing of the cords develops greater pressure and is probably instrumental in producing the generally greater volume of the trained voice. Dr. Steinberg spoke before the American Association to Promote the Teaching of Speech to the Deaf, meeting in Providence, R. I.

In photographing some voices in action, including his own, the vocal tract was filled with helium, alternating

with ordinary air. The lighter gas, helium, which caused Dr. Steinberg's voice to become a childish lisp, is revealed in the pictures as modifying action of the mouth, nose and throat cavities by raising their resonant frequencies. Vocal cord vibrations affecting pitch, however, were little, if any, affected and the vibrations do not seem to be critically dependent on these cavities.

Displaying a recently developed magnetic tape recorder, Dr. Steinberg said that this apparatus records words faithfully as spoken and reproduces them loudly enough for a deaf person who has some residual hearing to listen to the sound of his own voice, thus benefiting by self-criticism.

ITEMS

CALCIUM, bone-building mineral, may be the weapon for defense against lead poisoning, due to contamination of "practically all common foods" with traces of lead. "Increased amounts of calcium in the diet diminish the amount of lead which is stored in the body," is announced by Dr. Ludwig G. Lederer and Dr. Franklin C. Bing, of Chicago, in a report to the *Journal of the American Medical Association*. Extra calcium in the diet, they discovered, retarded the deposition of lead in the bones of growing animals. The bones are the chief place where lead is stored in the body. It was pointed out that even minute amounts of lead may be detrimental to health if they accumulate in the body. How calcium acts to keep lead from accumulating in the bones is not definitely known. Apparently it is the result of chemical reactions in the intestinal tract. Presumably the lead is made insoluble so that it can not be carried to the bones.

X-RAY photographs taken with an exposure short enough to show a moving bullet while passing through a block of wood were shown at the Pittsburgh meeting of the American Physical Society. The method was described by Dr. Charles M. Slack, research physicist for the Westinghouse Lamp Division, who developed the new x-ray tube with the collaboration of his associates. A very brief electrical surge of high voltage and amperage is obtained by charging a condenser, in several seconds, and discharging it through the x-ray tube. The voltage is about 100,000, somewhat less than that often used in ordinary tubes. But the current is far greater. The ordinary tube takes about half an ampere; this new tube uses about 2,000 amperes. In use, the bullet golf ball, or other object being studied, is made to break a fine tungsten wire. This is connected to a timing circuit, which releases the energy stored in the condensers.

A BROWNISH-YELLOW beast, with black spots, centuries ago leaped down a yawning cavern on a forested hillside in Tennessee—and because of that, a theory of science is demonstrated. Two boys, Clarence Hicks and Jack Kyker, of Sweetwater, Tenn., in exploring far back in Craighead Caverns, discovered bones and later footprints which were identified by the American Museum of Natural History, New York, as those of an extinct race of jaguars which once roamed North America. Dr. G. G. Simpson, associate curator, went to the caverns to see the footprints and additional bones. He made a cast of the footprints. The animal was closely related to the largest jaguars now found in South America.

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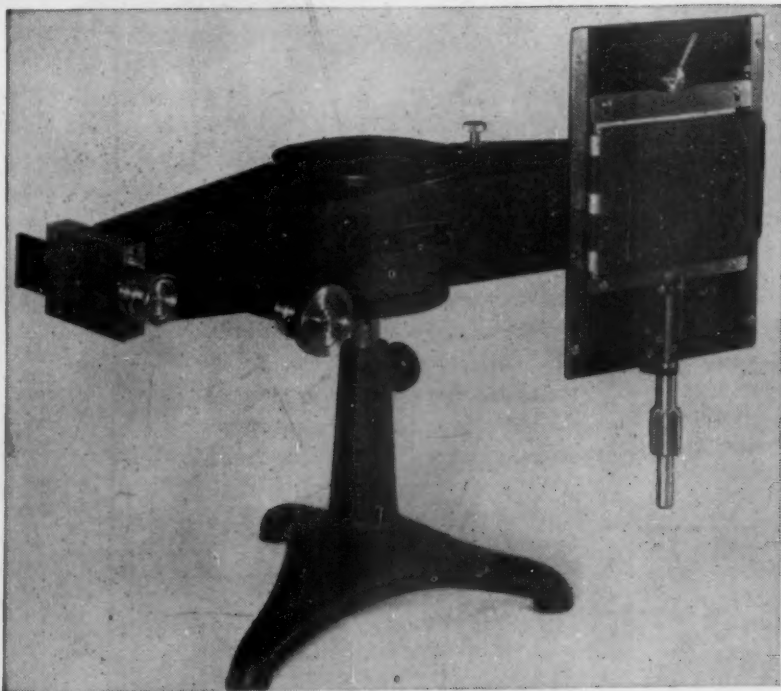
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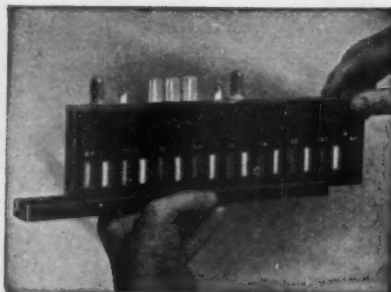


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